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Aluminum—A World Strategic Metal

THE acquisition of Austria and the Sudeten region of Czechoslovakia has done little to relieve the dependence of Germany upon foreign sources of both ferrous and non-ferrous metals. Great strides have been made by Germany since the war to relieve her most serious shortages, particularly aluminum, and this year Germany's estimated production of 175,000 tons of aluminum will probably lead the world. This tremendous increase in aluminum production has been occasioned by the replacement of considerable quantities of other metals by aluminum through striving for economic self-sufficiency, and the increase in airplane and vehicle construction. Germany, however, is still at a strategic disadvantage because over 90% of its aluminum ore-bauxite is imported from Yugoslavia, Hungary, Netherlands East Indies, Italy and France. It is reported that German metallurgists have developed a process for extraction of aluminum from clay but Germany would find it difficult in case of war to carry on her aluminum industry without foreign bauxite.

France has an admirable supply of aluminum ore and is self-sufficient in respect to this metal, but Great Britain imports almost all of her bauxite and hence Britain's aluminum industry would require naval protection in case of war. Italy can be self-sufficient both as to bauxite and aluminum production.

Japan owns no bauxite deposits and is forced to import her supplies from the Dutch East Indies and Greece, although some experiments have been made in working up Manchurian shale and Korean alunite. Production of magnesium, however, which partially replaces aluminum in her articles of lightweight construction has increased thousandsfold rising from 7000 lbs. in 1931 to an estimated 1,400,000 lbs. in 1936. Japan's metal resources are very poor, especially the non-ferrous metals and its "punitive" campaign to dominate China if successful will bring large metal deposits, such as tungsten, antimony and copper under its domination.

The production of aluminum in the world has steadily risen and in the United States, in keeping with this trend, the production of aluminum has risen from 102,000 metric tons in 1936 to 132,000 metric tons in 1937. Our aluminum industry imports over 50% of its ore but under a state of emergency it could easily become self-sufficient at a slight sacrifice in economy.

Aluminum is the third most abundant element of the earth's crust surpassing iron in abundance, and like other metals, it can be extracted from some of its lower ores, but as in the case of iron, as long as the rich ore (bauxite) is available it will naturally be utilized. The mad armament race throughout the world with the attendant need for aluminum in implements of war has dimmed the humanitarian utilizations of aluminum, such as in streamlined quiet trains, high compression automobile engines with increased power and economy, primers for paints, light-weight household utensils, such as kitchen mixers, flat-"irons", vacuum cleaners and thousands of other applications.

The rise in the world's production of aluminum from 1886 when Charles Martin Hall's discovery of the electrolytic process changed aluminum from almost a chemical curiosity to a commercial reality, to a 1938 production of over 500,000 metric tons has been phenomenal and the trend of production is still upwards!

Detroit Metal Show

The Detroit Metal Show was an unqualified success and should be a harbinger of business improvement.

The enthusiasm of both exhibitors and customers, the magnitude and splendor of the exhibits, and the portrayal of advancements in the science and art of metals pointed towards the goal of recovery. The newspaper headlines of *Thousands Re-hired by Automobile Factories* and *Pay-cuts Restored*, which greeted the visitors after leaving Convention Hall, presented a welcome contrast to the headlines of October, 1937, when business was tobogganing down the most abrupt decline of a generation. After viewing row on row of exhibits depicting advances in sheet metals, castings, alloys, control equipment, working equipment and surface treatment with the elaborate and accurate presentation of data, one is left wondering how it will be possible for future shows to transcend the Detroit show, but in consideration of past performances this will almost certainly transpire.

The cheery business tone of the Metal Show was in keeping with an upswing in the electrical goods industry as well as of general business.

Cadmium vs. Zinc Plating

The old adage that necessity mothers invention has been aptly demonstrated by the development and production adoption of bright zinc plating solutions shortly following the cadmium famine several years ago. The results attained with bright zinc plating indicate that it has won a place in the sun with cadmium, when coatings must be both decorative and protective of steel against corrosion.

Cadmium coatings are more easily soldered than zinc, are about equally protective to steel, possess a whiter color, a lower electrical contact resistance, are less sensitive to tarnish under high humidity and are deposited from solutions more easily controlled than zinc. The difficulty in soldering zinc using non-corrosive fluxes, especially in radio chassis assembly has been obviated, however, by the development of flexible resistance welding pliers enabling more positive joints to be secured at a lower labor cost than by soldering.

Zinc deposits are usually cheaper than cadmium and do not develop the blue-black discoloration frequently experienced with cadmium coatings that have been poorly rinsed or stored in absence of circulating air. Finger marking and surface tarnishing of both zinc and cadmium deposits may be overcome by protecting with the clear organic coatings especially developed for these metals. The modern bright zinc and cadmium coatings are truly beautiful and should be a source of pride to our plating industry.

Structure of Polished Metal Surfaces

The awakening of interest in the study of the structure of highly polished metal surfaces during the last several years has been due to the applicability of the electron diffraction technique to the study of surfaces. The low penetrating power of the electron beams in contrast to that of X-Rays allows structural determination of layers less than 100 Angstrom units (1×10^{-6} cm.) thick. The majority of the English students of this technique conclude that high polishing of metals leads to complete breakdown of the surface crystals resulting in an amorphous (completely non-crystalline) structure, but other scientists in this field notably F. Kirchner, in Europe, and L. H. Germer of the Bell Telephone Laboratory have raised objections which appear difficult to refute. A new supporter of the crystallinity of polished surfaces is M. L. Fuller of New Jersey Zinc Co.'s research division who shows that polished zinc surfaces yield electron diffraction effects that indicate oriented crystallinity. The halo diffraction patterns previously interpreted as indicating amorphous structures are suggested as resulting from the absence of surface textures suitable for the reflection type of photogram. It is difficult to conceive of applying sufficient mechanical stress to a surface to completely overcome the powerful orienting forces which lead to crystallinity, at least to particles of colloidal dimensions.

Calculations of the film heat developed during polishing suggest that temperatures above the melting point of most metals are reached, but this does not preclude the possibility of crystallization during the subsequent cooling particularly in such intimate contact with the mass crystalline orientive force of the basis metal.

No doubt years of further effort will be required with the electron diffraction technique and new tools of research used before general agreement as to the crystallinity of polished metal surfaces is reached but there is general agreement that polished metal surfaces do possess properties quite different from the unpolished metals.

Polishing, (buffing, coloring or burnishing in plating parlance) usually results in an increase in corrosion and tarnish resistance of plated coatings but this increase in corrosion resistance is not necessarily entirely attributable to the altered crystalline surface but is probably more appropriately related to the film of grease applied so intimately to the surface and to the formation in some cases of a uniform oxide coating formed under the influence of the high buffing temperatures.

The lack of general agreement on the interpretation of electron diffraction studies of polished metal surfaces is no disparagement to this splendid new tool for the study of thin films as it has already proved its worth in solving problems whose solutions were unattainable by any other means.

Increased Paint Efficiency By Improved Spraying Technique

By Willoughby G. Sheane

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The author discusses the savings resulting from a scientific motion study of spraying operations. Proper technique results in lower overspray loss, fatigue, material consumption and unit labor with a more uniform coating applied without dusting or runs. - - - Ed.

IT HAS been estimated that more than fifty percent of all spraying lacquers and enamels are lost, directly, through overspray and indirectly, when more than the minimum film thickness consistent with quality is applied. The average spraying efficiency is less than fifty percent, the highest efficiency established to date has been of the order of 60 percent.

What does this mean in terms of dollars and cents? It means that in many cases, but two quarts of each gallon of finishing material purchased are actually applied and that almost another quart is applied where it is useless for protection or decoration and further, it means that operators are being paid a premium for spraying excess materials. By improper technique they are tiring themselves and as a consequence, not producing all of which they are capable. The observation of a few fundamentals can go far toward increasing not only material and labor efficiencies, but will also result in a more uniform and therefore more satisfactory finish.

Spraying Principles

Let us assume that a material has been selected for a particular application with the spraying pressures, viscosity, fan shape and size determined, and finally, the adequate film thickness decided. From this point on, the matter is entirely in the hands of the sprayer and he can produce a fine finish with the least possible effort and expense; or he can produce a poor job with costly rework percentages. The last statement is particularly true, when, with no previous knowledge or experience, he is merely ordered to "paint" a piece.

Listed below are three points which have proved themselves to be the means toward obtaining the fullest value from the application of a gallon of lacquer or enamel:

1. The gun should be held perpendicularly to and the same distance from the surface being sprayed during the entire operation.
2. The gun should be kept wide open from the beginning to the end of the operation.
3. The motion of the gun above the surface should be such that the path described by the paint is as short as possible.

Point one is obvious in its implications. A spray gun held at an acute angle to a surface is not applying an even film, and probably the worst evil resulting from this practice makes itself apparent in the form of spray dust. Air dry lacquers and the increasingly used "fast" synthetic enamels are inherent in their common characteristic of forming spray dust.

As for keeping the nozzles the same distance from the piece at all times, there can be no dispute with the statement that a gun held too close to a piece will produce heaviness and runs, and that holding at too great a distance will result in overspray with a resultant dry, pebbly surface. Gun distance is important if we are to produce the wetness necessary for leveling and still not so wet a film as to produce sags.

Fundamental number two involves the quantity and condition of the paint leaving the gun nozzle. In automobile

engines, a very definite air-fuel ratio is maintained to give the highest possible efficiency and sprayers might well take a page from the book of experience of truck drivers and owners. They have found that numerous accelerations and decelerations are wasteful of fuel, hard on equipment and tiring to the operator. A sprayer who constantly "triggers" his gun, except at the end of a stroke, is wasting paint for his employer, and by fatiguing himself, is actually taking dollars from his pay envelope in decreased production per unit of work time.

A "gun waver" is an expensive sprayer! That is the essence of point three. Motions in excess of those absolutely necessary to apply an even paint film will tremendously increase the materials cost per unit of finished area. The shortest distance of gun travel is the most economical of paint, because, in general, the longer an operator points a gun at a piece, the more paint is consumed and the greater the chance for loss.

Case Study

A typical example of how finishing costs were lowered is shown in the sketches. The article was of galvannealed steel approximately thirty inches in diameter with a drawn lip

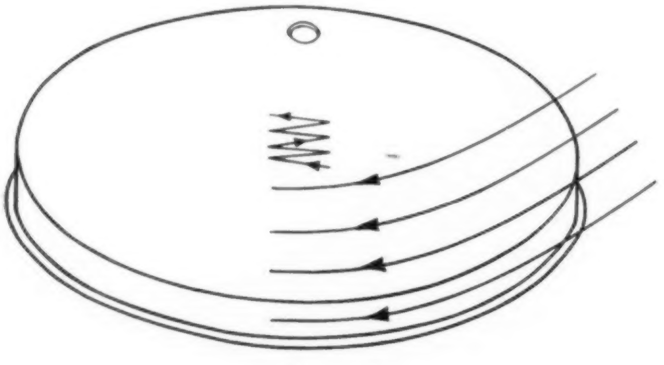

Figure I

of about one and one-half inches. The finishing material used was one of the new high baking urea formaldehyde types which was to be applied in a single coat without priming on both inside and outside of the piece, and then baked.

As originally planned, the job consisted of placing the piece, face up, on a rotating table and spraying the top

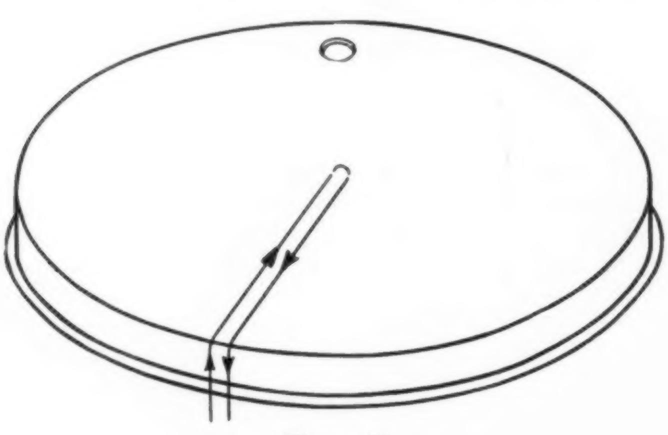

Figure II

surface in ten strokes, five of which were the mist coat and five the finish coat. It will be noted from Figure 1 that eight of the strokes were begun beyond the piece resulting in a tremendous loss. The operator believed he was "feathering" when, as a matter of fact, the rotating motion of the piece in itself accomplished this. The gun was seldom the same distance from the piece, and the short, curved path of the nozzle resulted in film thicknesses which varied from edge to center by as much as fifty percent.

The new technique involved a slightly slower rotating speed with a path as described in Figure II—a straight motion of forward to the center and back to the edge of the lip. Results: lower paint consumption, more uniform film, and higher production.

The inside surface, of necessity, was sprayed while the article was held in a stationary vertical position. Using the old method, which was determined by chance and not by intent, the operator made an average of twenty-three strokes (Fig. III), moved the gun back and forth horizontally at a high speed and traversed the distance from top to bottom at a low speed. The gun left the piece and shot paint into the air twenty-four times! Because of the rapid back and forth motion, the gun was never the same distance from the piece and the film thickness varied from area to area by almost fifty percent.

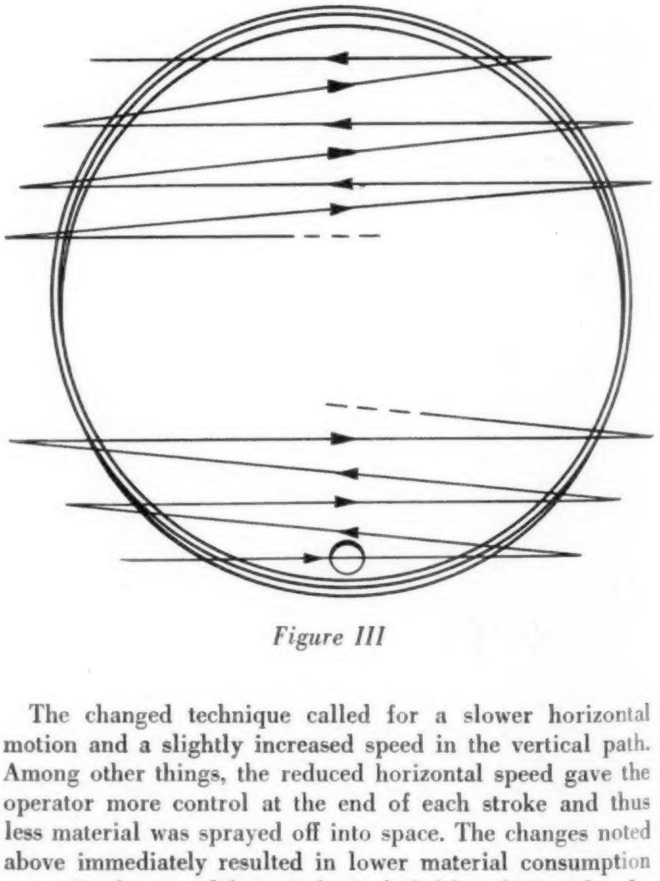

Figure III

The changed technique called for a slower horizontal motion and a slightly increased speed in the vertical path. Among other things, the reduced horizontal speed gave the operator more control at the end of each stroke and thus less material was sprayed off into space. The changes noted above immediately resulted in lower material consumption per unit of area. Other results included less fatigue for the sprayer, more satisfactory film thicknesses, and greater production per man-hour.

Fifteen minutes spent with an operator in the discussion of the method to be used in applying an organic finish will reap benefits many times over!

A New White Brass Plating Process

By Floyd Oplinger*

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A detailed report on a new white zinc-copper plating process is given. The deposits are semi-bright and may be buffed to a high lustre resembling chrome. The deposits are less porous than nickel and give a salt spray life directly proportional to the thickness. - - - *Editor.*

I. Introduction

RESEARCH work on brass plating using cyanide solutions has resulted in the development of an alloy plating process by means of which white alloy deposits containing zinc and copper at approximately a 3 to 1 ratio may readily be produced.

The process yields smooth, fine-grained, semi-bright coatings which may be buffed to a high lustre closely resembling chrome plate.

Also by means of addition agents very bright deposits can be produced directly from the bath.

Buffed samples on smooth base metal are characterized by remarkable resistance to tarnish and finger staining on handling. While handling makes the plate dirty, no permanent discoloration is produced such as is the case with zinc or cadmium.

Finger stained samples may be brought back to their original lustre by polishing with a cloth.

The deposits are suitable for decorative purposes on types of articles not subject to outdoor exposure, as for example, indoor hardware, lighting fixtures, tools, etc.

The deposits on outdoor exposure tarnish in periods of from 1 to 3 months with the formation of a greyish white film, which can, however, be removed by rubbing with a cloth wet with dilute ammonia water.

The deposits are not rust proof in the same manner as is zinc. They are, however, notably free from porosity and in this respect are superior to nickel deposits. Heavy deposits (0.001") protected steel from rusting in outdoor exposure for 315 days in the Niagara Falls, N. Y., atmosphere.

*Abstracted from Proceedings of 26th Annual Convention, American Electro-platers' Society.

Straight white brass baths are not suitable for barrel plating because the deposits are very hard and can be burnished only with great difficulty. No data covering experimental work on barrel plating of white brass deposits are available as yet.

The deposits are readily attacked in the salt spray, due no doubt to electrolytic action between zinc and copper. Heavy coatings will, however, protect steel from actual rust for long periods of time.

The process is a development of the laboratories of the Du Pont Electroplating Division.

II. Bath Composition and Operating Conditions

	Preferred oz./gal.	*Allowable Variations* oz./gal.
Zinc cyanide	8	8 to 10
Copper cyanide	2.25	1.85 to 2.4
Sodium cyanide	8	11 to 13
Caustic soda	8	8 to 11
Sodium sulfide	0.05	0.05 to 0.1

For Bright White Brass small amounts of addition agents as are commonly used for other bright plating processes are employed.

Operating Conditions

Anodes, 72% Zn—28% Cu
Temperature, 20°—80°C.
E. M. F., 1 to 3 volts
Maximum anode current density, 10 A./S.F. at 25°C.
15 A./S.F. at 80°C.
Anode efficiency, 80-100%.
Cathode current density at 25°C.—10 to 40 A./S.F.
" 40°C.—10 to 60 A./S.F
" 80°C.—10 to 100 A./S.F.
Cathode efficiency, 60-90%.

BRIGHT WHITE BRASS—The bath must be operated at room temperatures and at current densities of 10 to 25 A./S.F.

III. Important Features of the Process

1. *Ease of Control*

The solution is easy to prepare and seems to be simple to operate, control being readily maintained by two simple titrations (total cyanide and free alkali). The white brass alloy anodes automatically maintain the correct zinc and copper concentrations of the deposits except for the variations due to excessive dragout or faulty caustic soda replenishing.

2. *Cathode Current Density*

The optimum cathode current density range at 25° to 40°C. (77° to 104°F.) lies between 10 and 40 A./S.F.

Where higher current densities are required, somewhat higher temperatures are desirable in order to maintain a well balanced solution.

3. *Voltage*

The solution requires from 1 to 3 volts at the tank.

4. *Appearance of Deposits*

Plain white brass deposits have a semi-bright appearance and may be easily buffed to a high lustre closely resembling chrome plate. Cathode agitation is desirable in eliminating hydrogen striations on heavy weight coatings. There is no tendency to burn on the edges unless the current is too high. No pitting has ever been observed.

For many types of articles bright white brass deposits are more practical because buffing costs are lower and recessed surfaces are frequently difficult or impossible to buff.

Addition agents for bright plating are added after the solutions are made up.

5. *Cathode Composition*

This is approximately 28% copper, 72% zinc. Where heavy, smooth deposits are to be applied (0.0005″ or more) a moving cathode will be found helpful. Continuous filtration will also aid in producing maximum smoothness of plate.

Addition agents produce a slight reduction in the copper content of the deposit.

6. *Anodes*

The anodes are preferably of ball or bar design suspended in steel anode baskets. If conventionally shaped bar anodes are used, the steel anode hook should be cast through the full length of the anode to prevent breakage.

7. *Replenishing*

The successful continuous operation of this process requires the control of all four major ingredients, consequently the replenishing must be controlled by chemical analysis. Since the anodes automatically maintain the proper zinc and copper concentration of the solution over a wide range of current densities, for long periods of time, the routine bath maintenance consists of suitable additions of sodium cyanide and caustic soda, which can be readily determined by simple titrations. The free sodium cyanide, when calculated as in zinc cyanide solutions, should be maintained at from 4 to 6 oz./gal. (30 to 45 g./l.) while the caustic soda should be held between 8 to 10 oz./gal. (60 to 75 g./l.).

Addition agents are added as required.

8. *Allowable Variations in Bath Composition*

In general, excellent white brass deposits may be obtained by this process over a wide range of plating bath concentrations, provided the four essential plating bath ingredients are maintained at approximately the 8-2-8-8 ratio used in preparing a new solution, except the material dilution of this bath increases the copper content of the coatings somewhat, while increasing its concentration has the reverse effect. (See below).

When the process is operated for the production of a decorative finish, the copper content of the deposit should not exceed 30%, which is obtained within the following bath composition range.

	Oz./Gal.	*G./L.*
Total cyanide as sodium cyanide	11 to 13	82.5 to 97.5
Free sodium cyanide	4 to 5	30 to 37.5
Copper cyanide	1.85 to 2.4	14 to 18
Zinc cyanide	8 to 10	60 to 75
Caustic soda	8 to 10	60 to 75

Note: In order to keep the copper below the upper safe limit of about 30%, *the caustic soda concentration must not be allowed to go materially below* 60 g./l. (8 *oz./gal.*).

IV. Effect of Change in Composition of Bath Ingredients

Effect of Caustic Soda and Sodium Cyanide Concentrations Upon the Cathode Composition

Baths 1 and 2 illustrate the effect of varying the caustic soda; baths 3 and 4 that of free cyanide.

	No. 1	*No.* 2	*No.* 3	*No.* 4
Total cyanide as Sodium cyanide	85 g./1	95 g./1	84.3 g./1	99.3 g./1
Copper cyanide	8 "	30 "	17.3 "	17.3 "
Zinc cyanide	75 "	75 "	64.4 "	64.4 "
Caustic soda	30 "	90 "	56.0 "	56.0 "
Temperature	25°C	25°C	27°C	27°C
Cathode current density	30 A./S.F.	30 A./S.F.	30 A./S.F.	30 A./S.F.
Copper content of deposits	35.3%	28.4%	29.4%	30.2%

The potent effect of caustic soda on the cathode compositions is clearly shown in that with 30 g./l. of caustic as little as 8 g./l. of copper cyanide produced a 35.3% copper deposit, while a 90 g./l. caustic soda solution with 30 g./l. of copper cyanide produced satisfactory (28% Cu) deposits.

In contrast to the above, increasing the free cyanide 15 g./l. in a standard solution increased the copper content of the coating only 0.8%.

The above data illustrate the vital necessity of keeping the caustic soda concentration under control.

V. Current Efficiencies

1. Effects of Temperature and Current Density on Current Efficiencies and Compositions of Plate

The effects of bath temperature and current densities on the composition of the deposits are shown in the table below. The bath and the operating conditions used were as follows:

(By Analysis)	*g./l.*	*oz./gal.*
Total cyanide as sodium cyanide	85.3	11.44
Free sodium cyanide	31.2	4.16
Copper cyanide	17.3	2.32
Zinc cyanide	64.4	8.64
Caustic soda	60.1	8.05
Sodium carbonate	8.7	1.18

Operating Conditions

Anodes, 72% Zn, 28% Cu
Cathodes, cold rolled sheet steel
Ratio anode to cathode surface, 3 to 1 and 5 to 1
Cathode current densities, 10, 20, 40, 60 and 100 A./S.F.

Note: A fresh 10 liter solution was taken from a 40 gal. solution for each run. The current efficiencies were determined using a copper coulometer.

TABLE NO. 1

Cathode Compositions and Weights of Coatings at Various Currents and Temperatures

Temp.	*Cathode Current Density A/S.F.*	*Cathode Composition*	*Current Efficiency Cathode*	*Current Efficiency Anode*	*Bath Voltage*	*Metal Deposited per Hr. Oz./S.F.*	*Metal Deposited per Hr. Thickness*
25°C	10	26.3% Cu	86.3%	Over 100%	0.8	0.48	0.00076″
25°C	20	28.6% Cu	72.4%	Over 100%	1.2 to 1.3	0.85	0.00135″
25°C	40	27.6% Cu	53.0%	98.5%	1.8	1.14	0.00181″
25°C	60	28.2% Cu	52.0%	67.5%	1.8 to 2.5	1.76	0.00279″
40°C	20	31.8% Cu	81.2%	Over 100%	0.8 to 0.9	0.97	0.00154″
40°C	40	30.6% Cu	74.8%	Over 100%	1.3	1.64	0.00260″
40°C	60	31.1% Cu	62.8%	84.5%	1.6 to 1.7	2.00	0.00318″
80°C	20	31.0% Cu	84.0%	Over 100%	0.5 to 0.6	0.94	0.00149″
80°C	40	28.4% Cu	83.0%	Over 100%	0.6 to 0.8	1.97	0.00313″
80°C	60	24.1% Cu	86.0%	96%	0.8 to 1.1	2.53	0.00402″
80°C	100	25.1% Cu	80.4%	100%	1.4 to 1.6	4.08	0.00648″

Increasing the current density does not materially change the composition of the coating at 25°C. It does, however, cause the zinc content of the coatings to vary about 7% to 80°C. A satisfactory uniformity of cathode composition in the delta or white brass range on recessed articles is thus indicated over the entire temperature range of 25° to 80°C.

2. *Anode Current Efficiencies*

TABLE NO 2

	25°C	40°C
5 A./S.F.	107.7%	99.8%
10 A./S.F.	104.5%	105.5%
15 A./S.F.	78.4%	89.0%

VI. Corrosion Test Data

These tests were made on 6″ x 3″ x 0.019″ cold rolled steel sheets. The cleaning procedure used prior to plating was as follows:

(a) Degreased with trichlorethylene.
(b) Alkaline electric cleaner as cathode at 100 A./S.F. for one minute, and rinsed.
(c) Acid pickled 30 seconds in cold 1 to 1 HCl and rinsed.
(d) Plated with white brass at 30 A./S.F.

The deposits analyzed 27 to 29% Cu and 73 to 71% Zn. The samples were color-buffed with chrome coloring compound and degreased with trichlorethylene just prior to testing.

It should be remembered that the protection of steel by white brass, just as in nickel plating, requires that these protective layers be practically 100% non-porous. Since any holes or recesses in the base metal are more difficult to clean and plate uniformly, all such cavities make it more difficult to secure smooth, non-porous plate. The corrosion resistance of white brass electrodeposits is thus greatly improved by using the smoothest base metal surface commercially feasible.

1. *Hot Water Immersion Porosity Tests*

These tests were made by immersing the weighed white brass plated samples in hot (80°C.) distilled water for six hours and then counting the rust spots, with the following results:

TABLE NO. 3

No. of Samples	*Time of Plating*	*Thickness of Deposit*	*No. of Rust Spots per Sq. Ft.*
2	2.5 min.	0.00006″	All covered with small spots.
2	5 "	0.00013″	6000 per sq. ft.
2	10 "	0.00025″	None
2	15 "	0.00037″	None

TABLE NO. 4

Salt Spray Data

Sample No.	*Time of Plating*	*After Treatment*	*Wt. of Deposit oz./S.F.*	*Thickness of Deposit*	*Time of Breakdown First Rust*	*Thoroughly Rusted*
1A	5 min.	None	0.0824	0.00013″	125 hrs.	149 hrs.
2A	5 "	"	0.0811	0.000129″	125 "	149 "
5A	10 "	"	0.1718	0.00027″	308 "	484 "
6A	10 "	"	0.1644	0.00026″	253 "	380 "
8A	15 "	"	0.2336	0.00037″	308 "	484 "
9A	15 "	"	0.2405	0.00038″	308 "	484 "
11A	20 "	Buffed	0.2513	0.00040″	332 "	Little Rust in 484 hrs.
12A	20 "	"	0.2564	0.00041″	308 "	Little Rust in 484 hrs.
16A	30 "	"	0.4621	0.00073″	No rust in 484 hrs.	
17A	30 "	"	0.4128	0.00066″	Very little rust in 484 hrs.	

Deposits of 0.00025″ (0.156 oz./S.F.) and heavier showed complete non-porosity in this test.

For comparison, the porosity of nickel deposits from the Watt's solution using the same base metal is tabulated below:

TABLE NO. 5

Weight of Nickel oz./S.F.	*Thickness*	*No. of Rust Spots per S.F. in Hot Water Immersion Test*
0.2332	0.00032″	36
0.2247	0.00031″	18
0.2280	0.00032″	27
0.3011	0.00042″	36
0.3020	0.00042″	27
0.3020	0.00042″	18

2. *Salt Spray Tests*

These tests were made with a 20% sodium chloride solution at 25°C ± 2° in a standard salt spray box with the results tabulated below:

The salt spray life of these white brass deposits was found to be almost directly proportional to the thickness of plate. The highly non-porous nature of these coatings was confirmed by the salt spray tests in that even the 0.08 oz./S.F. coating showed no rusting for over 100 hours.

3. *Atmospheric Corrosion Tests*

The white brass plated samples were exposed on a wood testing rack in a residential district (DeVeaux Section) of Niagara Falls, N. Y.

The atmospheric corrosion data of white brass coatings on steel are tabulated below:

TABLE NO. 6

Sample Number	*Weight Deposits Oz./S.F.*	*Thickness of plate*	*Oz./S.F. in 315 days*	*Observations made during Tests*
1	0.695	0.0011″	0.0177	Deposits assumed a greyish color after coating over with dust. Cleaning with a soft cloth wetted with a 5% ammonia solution restored a pleasing bright luster after 315 days exposure. None of these samples showed any rust.
2	0.695	0.0011″	0.0180	
3	0.695	0.0011″	0.0154	
4	0.695	0.0011″	0.0154	
13	0.695	0.00113″	0.0170	
14	0.710	0.00113″	0.0178	
15	0.710	0.00113″	0.0176	
PI	0.259	0.00041″	—	Numerous tiny rust spots in 140 days.

In these tests 0.0011″ white brass coatings furnished complete protection against rusting and also a high resistance to staining and tarnishing during a 315 day outdoor exposure period.

Soft Solders

By A. H. Falk*

Bell Telephone Laboratories, Inc.

The author discusses the properties and applications of soft tin-lead solders. The melting ranges of various solders are considered in the light of the equilibrium diagram. - - - *Editor.*

THE joining of metallic materials by means of another material of lower melting point dates back to the days of the early metal craftsmen. Before the advent of modern machine methods and welding or brazing procedures, metallic parts had to be joined either by riveting or forging operations, or by fastening them with solder, a material of lower melting point. With the coming of the electrical era, the soldered joint became increasingly important, for it afforded a bond of high conductivity, easy to make and economical in space and cost. Today, in the Bell System and in all electrical industries, soldering is widely employed to secure an electrical and mechanical bond.

The solders described in this article are called "hand" solders, or soft solders, because of the relative ease with which they can be melted. Hard solders, which must be melted with a blow torch, though widely used in other industries, find comparatively little application in the Bell System.

There is no great art in making satisfactory soldered joints; fundamentally, soldering is merely the alloying of the solder with the surfaces of the parts to be joined. Most metals will alloy, at least to a limited degree, with the lead and tin which comprise the majority of soft solders. Any great difficulty that is experienced in soldering a joint is generally due to an external oxide or sulphide skin over the parts to be joined. To dissolve and eliminate this coating, consisting usually of oxides and sulphides of the alloyed metals composing the parts to be joined, various "fluxes" have been developed.

In making the many soldered joints in telephone apparatus which are in close proximity to coil windings or insulation servings, unusual care must be taken in the choice of fluxes. Ammonium chloride, zinc chloride, and hydrochloric acid are highly destructive of both metals and insulations and cannot be used unless the nature of the apparatus permits thorough removal of the fluxes by neutralization and washing after the soldered joint is made. Consequently rosin fluxed solder, conveniently arranged in tubular form, is widely used for telephone apparatus, particularly in the field. For untinned wire, which rosin does not clean sufficiently, naphthalene tetrachloride, the least corrosive of the liquefied fluxes, may be used.

All metallic materials and even many non-metallic materials, such as glass and porcelain, can be soldered if properly prepared. Aluminum is alone among the commonly used metals in offering difficulty because of the extremely rapid formation of aluminum oxide which is unaffected by the usual fluxing agents. Unless this oxide coating is completely removed it is impossible to obtain a satisfactory soldered joint on aluminum. The best way to remove this coating is to clean the surface with some abrasive such as emery or sandpaper or dissolve it off with some powerful acid such as hydrofluoric or nitric acid.

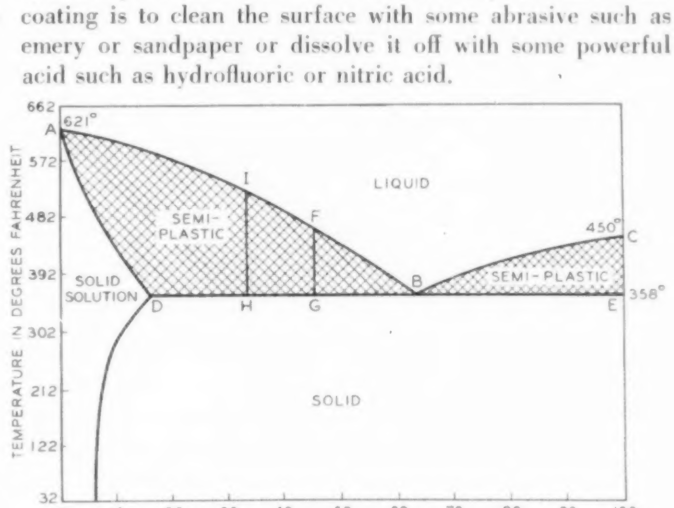

Figure 1. Tin-Lead Equilibrium Diagram.

Most alloys of lead and tin, indeed all those containing from 16 to 99 or more per cent of the latter metal, soften at about 358 degrees Fahrenheit as shown by line DBE in Figure 1. In that figure, the line ABC indicates temperatures at which all alloys of lead and tin completely liquefy.

*Reprinted from The Dutch Boy Quarterly, Vol. 16, No. 3, 1938.

In the intermediate temperature range between lines ABC and DBE, which is shown by the cross-hatched area in Figure 1, the solder is semi-plastic (partially liquid and partially solid). This range is important in determining the temperature at which a soldering iron should operate and the speed at which soldering can be done. Thus when used

Close-up of soldering terminals showing how soldering iron is applied to the terminals. The core solder is shown in upper left corner.

with any particular soldering iron the solder having the greater semi-plastic range will liquefy somewhat slower and will take longer to solidify completely than that having a lower range. For example, the semi-plastic range for the 45 per cent tin—55 per cent lead solder, as shown by line FG in Figure 1, is 114 degrees Fahrenheit and the range for the 33 per cent tin—67 per cent lead solder, as shown by line HI, is 172 degrees Fahrenheit. It is obvious, therefore, that it will take slightly longer to make a soldered joint using the 33 per cent tin solder than using the 45 per cent tin solder.

Referring to Figure 1, it becomes evident that if two parts to be joined by soldering are to function under operating temperatures in excess of 358 degrees Fahrenheit, it is necessary that a solder having a tin content of less than 16 per cent be used, because any alloy having a greater tin percentage than 16 per cent will begin to soften or become semi-liquid at this temperature. While soldered joints are not recommended for use at elevated temperatures, because the ultimate tensile strength falls off sharply with elevation of temperature, a lead-tin alloy having a tin content of 4 per cent has been found satisfactory for use under conditions where apparatus must function at temperatures within the semi-liquid range of the ordinary hand solders, and where very little stress is applied on the solder joints.

Compared to the metals being joined, soft or lead-tin solder is inherently weak, having an average ultimate strength of 4000 pounds per square inch at room temperature. Therefore, since the ultimate tensile strength of the solder is low as compared to the metal parts to be joined, the joints must be of sufficient area to bear the stresses to which they are to be subjected and consequently lap joints are preferable to butt joints. At temperatures in excess of room temperature, the ultimate tensile strength begins to fall off rapidly because of the nature of the metals which compose the solder alloy, both of which show increased cold-flow, or creep tendencies with an increase in temperature. Since soft solder, like the lead and tin of which it is composed, offers very little fatigue resistance, it cannot be safely used for a joint which is subjected to fatiguing stresses.

Soldering distributing frames with non-corrosive core solder.

Electrochemists Hold Seventy-Fourth Convention at Rochester

The seventy-fourth convention of the Electrochemical Society was held in Rochester, N. Y., October 12-15 with a total of 197 registrants. Three luncheon meetings were featured with talks by Dr. Otto Sandvik, of the Eastman Kodak Company, Rochester, on "Sound Recording," Dr. Charles O. Burgess of the Union Carbide & Carbon Research Laboratories on "Recent Developments in Alloy Cast Iron," and by Dr. William Blum, National Bureau of Standards, Washington, D. C. on "The Protective Value of Electroplated Coatings." Dr. Brian O'Brien presented a lecture on "Balloon Exploration of the Upper Atmosphere," after which an inspection of the Memorial Art Gallery of Rochester was held.

The convention was arranged by a local committee consisting of S. E. Sheppard, Honorary Chairman; T. J. Zak, General Chairman; W. T. Morgan, Budget and Finance; W. M. Tucker and J. C. Hudgins, Industrial Trips and Transportation, and G. A. Lux, J. J. Desmond, J. I. Reid, P. S. LoPresti, D. C. Carpenter as the General Committee.

A total of 36 technical papers were presented with two symposia, one on "Plastics in the Electrochemical Industry," presided over by Dr. S. O. Morgan, Bell Telephone Laboratories and the other entitled, "The Metallurgy of Silver" with Dr. Lawrence Addicks, Bel Air, Md., presiding.

The Metallurgy of Silver

This Symposium consisted of nine excellent papers which were productive of lively discussions. Abstracts of the papers follow:

Brighteners in Silver Plating Solutions, by B. Egeberg and N. E. Promisel.

On the premise that carbon disulfide is not the real brightening agent in the usual silver plating bath, the authors have considered other types of compounds that might be derived from the disulfide in such solutions and have investigated the efficacy of these materials as brightening agents. As a result of these studies, they have obtained an empirical formula applicable to certain types of brightening agents in cyanide silver solutions. Especially effective are thiourea and certain dithiocarbamates. It is suggested that the latter are really responsible for brightening action when carbon disulfide is the initial form of the addition agent.

Electrodeposition of Silver Alloys from Aqueous Solutions, by Aaron D. Johnson and F. C. Mathers.

This paper is presented as a survey of experiments on the electrodeposition of silver alloys. Nickel, cobalt, cadmium, copper, iron, zinc and lead were co-deposited with silver from aqueous solutions. The best operating conditions were studied and the properties of the deposited alloys determined. The baths were usually composed of solutions of complex salts, because of the proximity in them of the decomposition potentials of the various metals to that of silver.

Corrosion of Silver Anodes in Potassium Silver Cyanide Plating Solutions, by A. E. Thurber, Daniel Gray and R. H. Sholtz.

This study indicates that extremely small amounts of impurities have marked effects upon silver anode corrosion, particularly the presence of metals not readily soluble in KCN or metals that form salts insoluble in KCN. The physical structure also has a direct bearing on anode corrosion as well as the presence of carbonates and sulfur compounds in the solution.

Alloys of Silver and Iron, by Colin G. Fink. and V. S. de Marchi.

With the aid of powder metallurgy, iron-silver alloys at the iron-rich end were prepared. Ohmic resistance measurements show that silver alloys with iron. The maximum amount of silver found alloyed with iron was between 0.5 and 1 per cent silver. Further evidence that silver does alloy with iron is shown by the fact that the ferrite grains of a 50 Fe-50 Ag alloy are strained. This is similar to the observation made in the case of the copper-iron alloys. Corrosion studies of iron-silver alloys showed that small amounts of silver, up to about 1 per cent, improved the resistance of iron to the corrosive action of 10 per cent hydrochloric acid and 30 per cent acetic acid. Iron containing small percentages of silver behaves very similarly to iron containing small percentages of copper.

The Adherence of Thick Silver Plate on Steel, by F. C. Mathers and L. I. Gilbertson.

Adherence of silver plate to steel is due to several factors. Examination of adherent plates gives no evidence of continuation of crystal forms by the silver as in the

case of silver plated on copper. Increased adherence due to annealing may be due to the diffusion of silver into the steel at high temperatures. An important factor in adherence of silver plate to steel is the keying effect of silver deposited in the cracks and voids of the basis metal, although excellent adherence may be had on smooth polished surfaces, and in this latter case, intramolecular forces may play an important role.

The action of the strike on steel may be to cover the surface sufficiently to prevent action of the iron-silver couple which would otherwise result in an unequal potential distribution at the cathode in the plating bath. Less careful regulation of the time of striking is needed with a copper strike than with a silver strike. There seems to be no advantage in the use of two strikes on steel with respect to the adherence of the resulting plate.

Conditions recommended for cleaning, acid dipping, striking and silver plating iron and steel have been described.

The Electrodeposition of Silver from Solutions of Silver Nitrate in the Presence of Addition Agents, by Robert Taft and Lee Horsley.

A large number of addition agents and addition salts were introduced into a 1/4 molar silver nitrate solution to determine the effect, if any, on the cathode deposit. It was found that colloids of high molecular weight (above 250) produced abnormal or striated deposits. Dimethyl glyoxime produced a most striking effect of coarse crystal structure. On the other hand, smooth, fine crystalline deposits resulted upon the addition of certain higher aliaphatic and cyclic acids, as well as of certain inorganic salts. The lower fatty acids (formic, acetic and proprionic) did not produce fine grained deposits.

Silver Plating from Acid Complex Iodide Baths, by D. K. Alpern and S. Toporek.

Bright, adherent electrodeposits of silver are obtained at a pH of 1.7 from a bath containing 0.24 N silver, 3.47 N potassium iodide and 0.05 N sulfuric acid, with a current efficiency of 95 per cent. The quality of deposit is equivalent to that obtainable from cyanide baths. Baths containing, respectively, citric, acetic, maleic and hydrochloric in place of the sulfuric acid, give similar results. The acid component functions as a proton donor; no specific anion reaction is apparent. Both quality and efficiency increase as the pH is decreased from 3.0 to 0.65.

Cold Welding of Silver, by Allison Butts and G. R. Van Duzee.

Time-temperature-pressure relationship in pressure welding of silver was studied at temperatures from 200° to 400° C. and pressures up to 45,000 lb./sq. in. (3,150 kg./cm.^{2}). A curve was obtained showing the minimum time necessary to obtain adherent welds at various temperatures under a pressure of 45,000 lb./sq. in. and under varying pressures at a temperature of 400°C. Photomicrographs of welds obtained by rolling and by constant pressure in a fixed position indicate that welds obtained by rolling have greater strength. It was found that 200°C. is the lowest temperature at which adherent welds may be obtained, except possibly with greatly prolonged application of pressure. Above 200°C., the time necessary to produce an adherent weld decreases rapidly. Films of foreign matter on the surface of the silver being welded were less effective than expected in preventing welding. Graphite and talc were more effective than oil, grease and several other materials tried.

Silver Membranes, by H. J. Read and M. Kilpatrick.

The preparation of silver membranes by the distillation of zinc from a silver-zinc alloy has been studied. The effect of time and temperature of distillation and of composition of the initial alloy on the permeability of the resulting membrane have been determined. The size of the pores and their number per unit area of surface have been calculated and the results compared with estimates of other workers.

Papers of "Electrodeposition" Session

This session was presided over by Dr. E. M. Baker, University of Michigan, and consisted of the presentation of eight papers. In addition to the papers abstracted below, the following were presented: *Fabricated Porous Carbon,* by L. C. Werking, National Carbon Co., New York; *The Nkana Copper Refinery of Rhokana Corporation Ltd.,* by A. E. Wheeler and H. Y. Eagle, N. Y.; *A Direct Method of Determining the Polarization Voltage Using a Rotating Electrode,* by A. A. Boulach, Leningrad; *Effect of Solution Concentration in Electrodeposition of Manganese,* by S. M. Shelton and M. B. Royer, U. S. Bureau of Mines, Reno, Nevada, and *Beneficiating Ferruginous Bauxites Through Chlorination,* by S. de Marchi and Colin G. Fink.

Anodic Behavior in Cyanide Copper Plating Baths, by H. J. Read and A. K. Graham.

1. Polarization measurements have been made on copper and copper-iron anodes in several copper cyanide plating baths at several pH values.

2. Two points of inflection in the curve of anode polarization vs. current density have been associated with the cuprous and cupric reactions at the anode.

3. Changes in pH from 10.3 to 12.8 do not affect the reactions unless the carbonate content is very high. At a pH of 13.3 the copper acts as an insoluble electrode.

4. Increasing the free cyanide concentration of the bath extends the cuprous and cupric reactions at the anode to higher current densities.

5. Increasing the copper content of the bath has the same effect as added free cyanide, probably due to dissociation or conversion of $Na_2Cu(CN)_3$, thereby increasing the free cyanide concentration.

6. High tartrate concentration causes the cuprous reaction at the anode to occur sooner, and eliminates the cupric reaction.

7. A carbonate concentration as low as 9 oz./gal. (68 g./L.) causes the copper to act as an insoluble anode.

8. The presence of an iron anode along with the copper anode does not change the picture when using a copper anode alone, if the actual current carried by the copper anode is considered.

Ammonia in the Electrodeposition of Brass, by L. C. Pan.

The effect of ammonia in brass plating baths upon the color and composition of the hrass deposit is recorded, covering a wide range of cathode current densities and a range of Cu:Zn ratios. The color of the brass deposit is greatly improved by the presence of as little as 0.2-1.5 g. NH_3 per liter of electrolyte. In the absence of ammonia the composition of the brass deposit is very much dependent upon the Cu:Zn ratio in the electrolyte and upon the cathode current density. In the presence of ammonia, however, the composition range is extended and the brass deposit tends to assume a more or less uniform color and value. There are evidences of the copper ion concentration being suppressed by ammonia. The possible formation of a copper-ammonia complex with a smaller ionization constant than that of the $Cu(CN)_3^{=}$ ion is suggested. The presence of such a copper-ammonia complex would also increase the cathode polarization which, in turn, would account for the improved color and structure of the brass deposit. Ammonia was also found to improve the cathode efficiency of brass plating, possibly due to a decrease of hydrogen ion concentration in the electrolyte.

The Electrodeposition of Chromium from Trivalent Salt Solutions, by L. F. Yntema and W. H. Wade.

The deposition of chromium from a bath of chromic sulfate and ammonium sulfate was investigated. Best deposits were obtained from a 0.5 M chromium sulfate solution containing 4.0 M per liter of ammonium sulfate. The pH at which basic chromium salts precipitate from various solutions was investigated, and it was found that either ammonium sulfate or citric acid raises the pH of the point of precipitation. It was found that the addition of 0.1 mole of ammonium oxalate to the above solution gave the best results.

A technical session on "Corrosion and pH" with Dr. Robert M. Burns, Bell Telephone Laboratories, New York, presiding, proved productive of much lively discussion on the nine papers presented.

20 YEARS AGO

Staff of Electroplating Section Bureau of Standards, 1918.

W. Blum — *E. G. Reed* — *L. M. Ritchie*
G. B. Hogaboom — *F. J. Liscomb* — *W. E. Bailey* — *T. F. Slattery*
L. B. Ham — *A. Frieden*
A. D. Bell — *Miss H. A. Nixon now Mrs. J. Eisinger* — *Miss Zalia Jencks now Mrs. W. Gailey* — *Helen E. Hester*

Notes on Metal Finishes

By Palmer H. Langdon

Assistant Editor

Methods and solutions used to plate and finish the samples exhibited by the branches of the American Electro-Platers' Society at the recent Convention in Milwaukee, June 13-17, 1938.

ONE of the features of the Milwaukee Convention of the A. E. S. was the exhibit of articles plated by members of the various branches in their competition for the METAL INDUSTRY Cup. Many of these exhibits were accompanied by detailed descriptions of the methods and solutions used, which made them doubly interesting. We report, therefore, the details of some of the outstanding exhibits as they were noted in the description books. The methods given are in large scale commercial operation, turning out products which are widely known to the public and accepted as of standard high quality.

C. G. Conn., Ltd. Band Instrument Exhibit, sponsored by F. K. Savage, chemist.

METAL CLARINET, FINISH NO. 2

A. Body

1. Clean (still) for 10 min.
2. Clean anodically at 6 volts for 5 sec.
3. Bright dip momentarily in:
   H_2SO_4-2 parts
   HNO_3-1 part
4. Rinse
5. Blue dip, composed of:
   HgO-0.1 oz./gal.
   NaCN-4 oz./gal. (free)
   Time, 2-3 secs.
6. Rinse
7. First strike:
   Silver ... 0.6 oz. Troy/gal.
   NaCN ... 7.0 oz./gal. (free)
   Na_2CO_3 .. 3.0 oz./gal.
   Time, 4-5 secs.
8. Rinse
9. Scrub with pumice (FF).
10. Rinse
11. Blue dip as above (see Step 5)
12. Rinse
13. Second strike:
    Silver .... 1 oz. Troy/gal.
    NaCN ... 7.0 oz./gal. (free)
    Na_2CO_3 .. 4.0 oz./gal.
    Time, 10 min.
    Voltage, 1-1.5
14. Silver plate:
    Silver .... 3.5 oz. Troy/gal.
    NaCN .... 6.5 oz./gal. (free)
    Na_2CO_3 .. 4.0 oz./gal.
    Brightener, CS_2
    Voltage ... 1.0
    Current density, 2-3 amps/sq.ft.
    Time, 2 hrs.
    Temp. room
    Agitation—rotary work rod, 4 ft. diam.
15. Rinse
16. Scrub the bell with pumice (FF) and round sand
17. Cork the throat
18. Place a rubber washer over the bell
19. Fill with gold solution and insert a platinum anode
20. Gold plate in solution:
    Gold ..... 4.0 dwt./gal.
    KCN ... 0.1 oz./gal. (free)
    Na_2HPO_4 addition agent
    Temp., 60-65° C. (140°-149° F.)
    Time—15 min.
    Voltage regulated by size of anode
21. Rinse
22. Scratch brush
23. Burnish gold bell
24. Buff silver

B. Keys on Clarinet

1. Wire
2. Degrease in 3 phase degreaser
3. Clean (still) for 5 min.
4. Clean cathodically (6 volts) for 10 secs.
5. Rinse
6. Acid dip (4% HCl)
   Time—2-3 secs.
7. Rinse
8. Nickel strike (to prevent spotting out) in following solution:
   Nickel ...... 2 oz./gal.
   H_3BO_3 ...... 2 oz./gal.
   NH_4Cl .. 2 oz./gal.
   pH, 5.8-6.0 (colorimetric)
   Time—10-15 min.
   Voltage—1-1.5
   Agitation—moving work rod.
   Temp.—room
9. Rinse
10. Silver strike in following solution:
    Silver .... 0.5 oz. Troy/gal.
    NaCN .... 8.0 oz./gal (free)
    Na_2CO_3 .. 2.0 oz./gal.
    Time ..... 4 to 5 secs.
    Temp., room
11. Silver plate in following solution:
    Silver .... 3.5 oz. Troy/gal.
    NaCN .... 6.5 oz./gal. (free)
    Na_2CO_3 .. 8.0 oz./gal.
    Brightener—CS_2
    Voltage—1.0
    Current density—3-4 amps per sq. ft.
    Time: 1.5 hours
    Temp., room

Agitation, rotary work rod, 4 ft. diam., 1 R. P. M.

12. Rinse
13. Dry (hot water and air)
14. Buff with rouge
15. Burnish bell

C. Bugle Finish

1. Wire
2. Potash cleaner (still) 4-5 min.
3. Potash cleaner (elec.)—10-15 secs.
4. Rinse
5. Acid dip:
   HCl, 4% by weight
   Time, 2-3 secs.
6. Rinse
7. Cork
8. Copper strike:
   Copper .... 0.6—0.8 oz./gal.
   NaCN ..... 0.1—0.2 oz./gal. (free)
   Na_2CO_3 .... 6.0 oz./gal.
   Temp. ..... 75-80 deg. C. (167°-176° F.)
   Time, a few secs.
9. Rinse
10. Bright nickel plate
11. Rinse
12. Pull slides and uncork
13. Clean and strike slides in nickel tank to whiten
14. Rinse
15. Dry with air
16. Inspect and touch up when necessary
17. Rack
18. Place special lead anodes
19. Chromium plate in 33 oz. solution
20. Rinse, cold water
21. Rinse, hot water
22. Dry with air
23. Chrome buff when necessary, with chrome compound

D. Baton Staff. Wood ball, gold lacquered. Metal staff treated as follows:

1. Stock—aluminum tubing
2. Rack
3. Clean (still)
   Time—Until vigorous gassing starts
   Wetting agent—½ of 1% weight of soluble salts
4. Clean cathodically
   Time: 2 secs.
   Same solutions
5. Rinse
6. Acid dip:
   HNO_3—35% by weight
   Time: 10 secs.
7. Rinse
8. Zinc strike:
   $Zn(CN)_2$ .... 4 oz./gal.
   NaCN ...... 4 oz./gal.
   NH_4OH ..... 4 oz./gal.
   Peptone .... ⅛ oz./gal.
   Temp. 50-55° C. (122°-131° F.)
   Voltage—6
   Time: 15-20 secs.
9. Nickel plate in following solution:
   Nickel (as metal) . 2 oz./gal.
   NaCl .... 2.0 oz./gal.
   H_3BO_3 .... 2.0 oz./gal.
   Na_2SO_4 ....20 oz./gal.
   pH .... 6.1 (colorimetric)
   Agitation—hand, vigorous during striking period.
   Voltage: 3 volts for 1 min.
   2 volts for 3 min.
   1½ volts for 45 min.
10. Rinse
11. Unrack; dry (hot water)
12. Nickel buff

Westinghouse Elec. & Mfg. Co. V. M. Garrison

Routine for plating electric toaster, flat iron and waffle iron:

1. Polish
2. Soap clean
3. Rinse
4. Electric copper cleaner
5. Rinse
6. Nickel plate
7. Rinse and dry
8. Nickel buff and color
9. Electric cleaner
10. Rinse
11. Acid dip
12. Rinse
13. Chrome plate
14. Rinse
15. Chrome color, inspect and pack

Formula for nickel plating solution:

Metallic nickel .... 3.5 oz./gal.
NaCl .... 4 oz./gal.
Epsom salts ...... 4 oz./gal.
H_3BO_3 .... 4 oz./gal.
pH .... 6.2 (colorimetric)
Temp. ....90° F.
Current density—8 amps. per sq. ft.

Troy Sunshade Company. Louis Smith and M. R. Moody. Four chairs, table, stool and costumer; furniture of steel tubing

Each of the articles was taken through following plating cycle:

1. Racked and cleaned with tetrachloride
2. Electric cleaner (5 oz./gal. with the work as the cathode)
3. Cold water rinse
4. 20% HCl dip
5. Cold water rinse
6. Rochelle salt copper (25 min.) at 40 amps. per sq. ft.
   Copper cyanide ..... 3.5 oz.
   Sodium cyanide ...... 4.5 oz.
   Rochelle salts .... 8 oz.
   Soda ash .... ½ oz.
   Water .... 1 gal.
7. Cold water rinse
8. Hot water rinse
9. Copper buff
10. Electric cleaner—4 oz./gal. (Work is the anode).
11. Cold water rinse
12. 15% H_2SO_4 dip
13. Cold water rinse
14. Bright nickel (35 min.) at 50 amp. per sq. ft.
15. Cold water rinse
16. Hot water rinse
17. Nickel color
18. Chromium plate in 33 oz. solution for 2 minutes.

The Copper King, luxurious new observation-lounge car for the City of Los Angeles. Walls are covered with satin-finished Copper. Furnishings are Copper and Bronze.

Courtesy of Copper and Brass Research Assoc.

Pictures of Detroit Metal Show

Crowds at DuPont Booth Watching Bright Copper Plating.

A Portion of the Throng at Binks Mfg. Co. Booth.

George Spencer and G. E. Huenerfauth Relaxing at Crown Rheostat and Supply Booth.

Part of International Nickel Co.'s Booth.

Portion of Booth of Newly Formed Bright Nickel Corp.

Deep Drawn Auto Shells at the Bethlehem Booth.

PLATING AND FINISHING
FABRICATION — ASSEMBLING
METALLURGICAL — ROLLING
CASTING AND JOINING

SHOP PROBLEMS

TECHNICAL ADVISORS

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Detroit, Mich.

H. M. ST. JOHN
Chief Metallurgist,
Detroit Lubricator Co.,
Detroit, Mich.

When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Full information is necessary in order to render proper service.

Tarnished Brass

Q.—At present we are faced with the problem of tarnishing of our metal products and are trying to find the cause for this tarnishing. We manufacture a compact of which the basic part is brass and it goes through various departments that include plating, polishing, enameling, etc.

Also please be advised that this does not occur during the winter months.

A.—The difficulty is due to moisture under the lacquer.

In warm and humid weather it is difficult to prevent some moisture from forming on the articles. It is also difficult to obtain a good drying job.

A suggested remedy is to dip the articles in xylol, or lacquer solvent, before lacquering. The pre-dip treatment will remove some of the moisture from the surface and remove this as a cause of staining under the lacquer.

For improvement in the grade of lacquer to use to alleviate this defect consult the lacquer manufacturer.

—G. B. H., Jr.

Silver Cyanide

Q.—How can we make silver cyanide from silver and cyanide?

A.—The silver can be dissolved in nitric acid. Drive off excess nitric, then add the correct amount of sodium cyanide. Do not add excess cyanide as this will cause the precipitated silver cyanide to go back into solution. Theoretically, 1 gram of silver metal (converted to the nitrate) requires .455 grams sodium cyanide to precipitate it.

Or, you may run the silver into a cyanide solution by electrolysis. Use the silver as anode, and use a steel cathode in a porous pot. Apply 2 volts. The cyanide solution can be strong or weak depending upon how much silver is to be dissolved. This method will give sodium silver cyanide and not silver cyanide.

In general it is more economical to buy silver cyanide than to make it in small amounts.—G. B. H., Jr.

Zinc on Iron

Q.—I am finding difficulty in electroplating zinc from $Zn(CN)_2$ solution directly onto sandblast work due to the preferential deposition of hydrogen.

Do you think you could advise me of a production bath and the workable conditions which are likely to overcome this trouble?

I have tried practically all the preplating dips known and the only one which answers is hydrochloric acid dip which of course has the disadvantage of being practically useless on hollow fittings due to the difficulty of removing the last trace of corrosive acid.

A.—It is assumed that you are working with cast or malleable iron.

The low cathode efficiency is probably due to the presence of the carbon in the iron on which the overvoltage of hydrogen is low, thus resulting in most of the current depositing gas instead of metal.

The simplest method of getting the zinc to cover is to add a small amount of cadmium oxide to the zinc solution and to use a small cadmium anode on the anode rod. This will result in the piece receiving a cadmium coating which will then take zinc. Or, the work may be struck in a cadmium solution.

Cast iron is preferably plated in the zinc solution after sand blasting and without the use of the muriatic pickle.

—G. B. H., Jr.

Peeling of Nickel on Leaded Brass

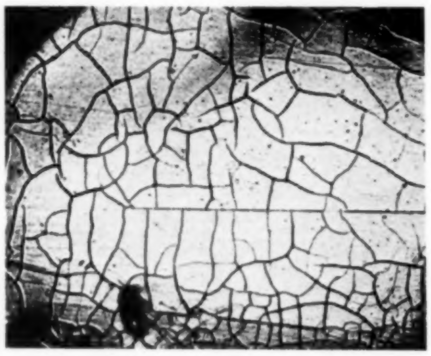
Q.—From 5% to 10% of the basin faucets which we plate peel at the tip of the spout. The spouts analyze: copper 77%, tin 1.5%, lead 9% and the balance zinc. They are plated with the following sequence: (1) Electroclean anodically at 200°F., (2) Rinse at 110°F., (3) Cold water rinse, (4) Dip in sodium cyanide 6 ozs./gal. (5) Rinse in cold water. (6) Copper flash 40-50 seconds. (7) Rinse in cold water. (8) Nickel plate for 20 minutes at 11 amps./sq. ft. and 80°F. in solution containing 3.25 oz./gal. nickel, 3 oz./gal. sodium chloride, 5 oz./gal. of boric acid. (9) nickel buff. (10) Chrome plate 3 min. at 200 amps./sq. ft. and 115°F. in 53 oz./gal. solution. What is wrong?

A.—The alloy which you are using is in the leaded brass category as both the zinc and tin contents are well within the range of solid solubility in copper. The chief offender is lead which has a low strength and forms salts which are difficultly soluble. There are many sequences which may be used but the one recommended below has been in successful production use for many years. An alloy of this type should not be cleaned anodically due to rapid oxidation of the brass with solution and oxidation of the lead. The faucets should be pre-cleaned by one of the following methods stated in descending order of preference: (1) vapor degreasing, (2) emulsifiable solvent cleaning, (3) solvent naphtha cleaning. The purpose of the pre-cleaner is to shorten the alkaline cleaning time.

After pre-cleaning, clean cathodically which should not require more than 30 seconds. If the work turns dark it is due to plating of a metallic smut composed of lead, zinc, tin, and iron and when the smut becomes heavy the cleaner should be discarded. If the work does not darken during cathodic cleaning, rinse in running water and dip directly into the muriatic acid dip but if darkening occurs, reverse the cleaner current for from 3-5 seconds preferably in a separate tank. The reversal will de-plate most of the zinc, tin and lead in the smut but will not remove the iron or copper. Some oxidation of the lead, copper and iron occurs which makes them more readily soluble in the subsequent dips.

Rinse the work in running water and dip into a solution of caustic soda 2 oz./gal. with 3 oz./gal. of sodium cyanide. The caustic soda removes lead oxides and the cyanide brightens the brass. Rinse in running water and dip for 10 seconds in 25% muriatic acid which serves to neutralize any alkaline film and removes any traces of remaining oxides. Muriatic acid is preferable to sulfuric as its salts are more soluble (particularly lead) and it has a more energetic action on tin oxides.

After rinsing, nickel plate. Your solution may be satisfactory but for a cold solution I believe that a double nickel salt solution is preferable. If a Watt's solution is available use it as every effort should be made to produce a ductile deposit. If burning occurs on the tips of the spouts use screening as burning is fatal to good plating.



Cracked nickel plate due to plating from too cold solution.

The nickel coloring should be done with as little heating as possible as hard pressure and high temperatures will cause plastic flow of the lead under the nickel which will only show up after chromium plating as blisters.

Correct buffing technique is vital as I have seen many peeling troubles result after good plating due to "strong-arm" buffers!

The chromium plating bath which you are using should be satisfactory. However, a lower current density of 125-150 amps./ft.^{2} and a plating time of two minutes would be less liable to cause peeling than the values which you are now using. Cleaning preceding chromium plating should be short, 2-10 seconds to reduce hydrogen absorption into the deposit and the shortened plating time and lower current density are towards this end. The faucets should not be burned during chromium plating especially at the tip as all subsequent buffing should be avoided. This can be done by proper racking and again much blistered and peeled nickel has been caused by burning and buffing chromium as well as over-plating. Burning of chromium should be a cardinal sin in plating.

The answer to this question is somewhat extended as the sequence mentioned and troubles considered are typical for most alloys containing lead.

—W. R. M.

Spotted Plate

Q.—We are sending under separate cover one of our plated bases. Please note the stains or spots on the sides of same and inform us as soon as possible as to their possible cause. The base is made up of about 95% zinc, balance aluminum.

A.—The stains or spotting out are due to several causes. For a good exposition of this subject see the "The Spotting of Plated or Finished Metals" by W. P. Barrows, Research Paper No. 72, obtainable from the Superintendent of Documents, Washington, D. C.

The following is from page 1115 of the booklet: "Stain spots usually involve at least three factors—(a) porosity of the metal (b) the presence in the pores of hygroscopic (moisture absorbing) compounds occluded or formed by action of alkaline or acid cleaning, plating, or coloring solutions, and (c) the absorption of moisture by the compounds in the pores."

It is not always possible to make an absolutely non-porous casting. Therefore other indirect methods are used. One is to allow the work to stand for a while so that it spots out, and then refinish it. Another is to use a "non-spotting" type of lacquer which will greatly reduce the tendency for salts in the pores to take up moisture. Baking before lacquering, or alternate rinses in hot and cold water, after plating, in order to flush out salts can also be tried.

Too high a temperature in casting will tend to produce blow holes. Not over 4% aluminum is considered best for castings to be plated.—G.B.H., Jr.

METALLURGICAL DIGEST

SELECTED ABSTRACTS ON CASTING—ROLLING—PHYSICAL METALLURGY

Abnormally Large Grains in Rolled and Annealed Copper by M. Cook and C. Macquarie. Metals Technology, Vol. 5, No. 6, 1938.

Abnormally large crystal sizes can be developed in rolled copper strip or sheet provided the final cold-rolling reduction exceeds about 95 per cent and the final annealing temperature is of the order of 1000°C. Similarly, large crystal structures can be produced under the same conditions of final annealing, with a final cold-rolling of not less than about 85 per cent, provided the temperature of the penultimate annealing does not exceed 550°C. and that the total cold-rolling exceeds 96 per cent. The structure after these heavy reductions is similar whether the final rolling is the same or normal to the direction of previous rolling.

If the final rolling reduction is limited to 30 to 70 per cent reduction, and is effected normal to the direction of previous rolling, the largest crystal size is obtained by annealing finally about 800°C. to 850°C. The crystals are smaller than those obtained with heavier final rolling reductions followed by annealing at 1000°C., and differ from them in being much more equiaxed and free from circular markings and structures. For the production of these crystals by finally cross-rolling with a reduction of about 50 per cent and annealing at 800°C. to 850°C., the penultimate rolling reduction of about 90 per cent appears to be necessary, and the optimum annealing temperature prior to the final cross rolling is about 450°C.

These results have been obtained with two brands of H. C. copper, but with a phosphorus-deoxidized copper of comparable purity, except for the residual phosphorus, and less pure copper such as tough-pitch and deoxidized arsenical, large crystals were not produced by either sequence of operations.

Recent Progress in the Application of Magnesium Alloys. D. B. Winter, Metallurgia, Feb. 1938, page 119.—The application of magnesium alloys, particularly those of the Electron group, has greatly increased in European industrial countries. Their advantages are: (1) Low specific gravity (1.8) and high strength/weight ratio, (2) Machining qualities which exceed those of all other metals, (3) High resistance to fatigue, (4) High heat conductivity, (5) Ease of casting with freedom from pinholing. In the heat-treated condition the casting alloys have ultimate strengths up to 19 tons/sq. in. and elongation up to 14%. Pressure die castings have also been successful.

The Effect of Small Additions of Tellurium on the Mechanical Properties of Pure Tin. By D. Hanson and W. T. Pell-Walpole. J. Inst. Metals, 1938, 63 (Advance Copy). Additions of up to 0.1 per cent, tellurium slightly improve the Brinell hardness and tensile strength of tin, but heat-treatment of the alloys does not produce permanently improved properties. These tellurium-tin alloys have a remarkable capacity for work-hardening in the chill-cast state, but this is diminished if the ingots are annealed before deformation. Grain-size may be a factor affecting work-hardening capacity. Tellurium considerably improves the creep strength of pure tin, both in the cast and in the rolled conditions. The work-hardening properties of these alloys may form a valuable guide to their relative creep strength.

Grain-size measurements were made after various mechanical and thermal treatments, and it was found that the grain-size has a marked effect on the creep strength of these alloys; this confirms previous work by Hanson and Sandford on the creep strength of other tin-rich alloys.

Brass Die Castings. Methods of Production and Control. U. C. Fox. Metal Ind. (London), March 18th, 1938, page 316.—Die casting is of growing importance and in this survey every aspect of practice applied to the brasses is discussed. Die steels, die design, casting methods, applications and economic factors are all considered. With present die steels the life of a die may range between 10,000 and 50,000 operations, the higher figure applying to small, thin-walled castings. A good die lubricant is an essential item; a water suspension of colloidal graphite gives good results. Many parts formerly sand cast can now be more economically die cast because of lower machining costs. Many parts now forged can probably be die cast satisfactorily and more cheaply.

Mechanical Properties of Some Tin Bronzes. H. Lepp, Intern. Tin Research Development Council, Tech. Pub. D, No. 3 (1937): Chem. Abstracts, March 10th, 1938, col. 1635.—The majority of investigators are in agreement that the solid solubility (alpha solid solution) of tin in copper is at least 13%. This can be extended to 14% if the bronzes are efficiently degasified. It is probable that absorbed gases favor formation of the delta constituent. The liquid bronzes readily absorb gases. During solidification the escaping gas leaves inclusions, causes porosity and inverse segregation. By suitable degasification these can be precluded. Tests on castings made from melts of virgin metals or clean scrap showed that bronzes with up to 14% tin became perfectly malleable both hot and cold, after suitable degasification, and the mechanical properties in the worked condition were improved. The tensile strength and elastic limit of annealed specimens increased with the tin content. The elongation increased up to about 10% tin and then decreased.

Aluminum Bronze Gravity Die-Casting. Arthur Street. Metallurgia, March 1938, Page 185.—This alloy, in the die-cast form, has a tensile strength of about 35 tons per square inch, elongation between 25% and 35%, and a Brinell hardness of 120. It has a high resistance to fatigue and resists most forms of corrosion. The alloy generally used contains 10% aluminum; the safe limit is 10.5%, due to danger of brittleness. Brinell hardness should be held between 110 and 130. Turbulence in casting must be avoided. An accuracy of plus or minus 0.005 in per inch can be maintained, and holes greater than 3/16" diameter can be cast provided the cores have a taper of about 0.015" per inch. Die life ranges from 5,000 to 15,000 casts. Cores are made from alloy steel, but for dies untreated low-carbon steel, nickel steel, semi-steel or cast iron may be used. Iron, manganese or nickel are sometimes added to the alloy, but in such cases, to avoid brittleness, the percentage of aluminum must be reduced. These more complex alloys may be improved by heat treatment.

Immiscibility of Lead Bronzes. W. Claus. Giesserei, Vol. 24, page 593 (1937); Chemical Abstracts, April 20, 1938, Col. 2888.—Heavy bearings are commonly made from copper alloys containing lead, tin and a small amount of nickel. The systems copper-lead, copper-lead-nickel and copper-lead-tin are illustrated and discussed. A region of liquid immiscibility is characteristic of these systems. Inverse segregation may cause considerable difference in the composition from inner to outer surface of bearings. A bearing cast from an alloy containing copper 73.5, lead 15, tin 10 and nickel 1.5%, had at the extreme outer surface a layer containing copper 1.4, lead 91.7, tin 5.1 and nickel 1.8%. The practical method of preventing segregation is to remove the piece from the dry sand mold about ten minutes after casting and quench in water.

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—FINISHING—RUST PROOFING—LACQUERING

Effect of Corrosion on the Durability of Paint Films by V. M. Darsey, Ind. & Eng. Chem. 30, 1938, p. 1147. The durability of paint coatings applied over different metals depends to a great extent on the corrodibility of the base metal in the environment to which it is exposed. Chemical treatment of easily corrodible metals so as to convert their surfaces to a more stable and less reactive phosphate coating materially increases the durability of applied paint coatings. This treatment provides increased adhesion of paint films to the base metal and thus retards the peeling or chipping of the paint away from an abraded area.

Paint coatings containing a corrosion-inhibiting substance have greater durability than similar paint coatings without the corrosion-inhibiting compound. Most paint troubles have their beginning at the point of contact between the paint and the metal surface, and any recommended schedule for painting should not only include the composition of the paint but also specify the treatment of the metal prior to painting.

Brighteners in Silver Plating Solutions. By B. Egeberg and N. E. Promisel. Trans. Electrochem. Soc. Preprint 74-13, 1938.

On the premise that carbon disulphide is not the real brightening agent in the usual silver plating bath, the authors have considered other types of compounds that might be derived from the disulphide and have investigated the efficacy of these materials as brightening agents. Thiourea was found to be particularly effective and in concentrations from 35 to 40 grams per litre, deposits could be obtained superior to any of those obtained by the use of carbon disulphide. The current density for optimum brightness at 180°F. was from 5 to 8 amperes per sq. ft., with higher values permissible by using agitation. The free potassium cyanide should be about 20 grams per litre. It was noted that salts of substituted dithiocarbamic acid as a group caused brightening actions on silver deposits resulting in mirror-bright deposits far exceeding results hitherto obtained with carbon disulphide.

Influence of the Surface Condition of the Basis Metal on the Corrosion Protection of Electrodeposits. By M. Schlotter and H. Schmellenmeier. Zeit fur Metallkunde, Vol. 30, pp. 178-181, May 1938. The authors used porosity tests to determine the effect of the basis metal condition on the degree of corrosion protection offered by electrodeposits. The roughness of the surfaces of the copper strips used was obtained by anodically etching the samples in 10% sulphuric acid for different lengths of time. Thin deposits of bright tin .00001" to .00005", as well as thin, bright and dull deposits of nickel, were used and the porosity tests indicated that the plates were more porous when the original basis metal was rougher. A noticeable difference was obtained for thin coatings of nickel between dull nickel deposits and bright nickel deposits, and it was found that bright nickel tended to fill the crevices more readily than dull nickel. The authors also concluded that the condition of the basis metal surface must be considered when evaluating the thickness of coating necessary for any certain desired corrosion protection.

Aluminum-Coated Steel Wire. By Colin G. Fink, Wire and Wire Products, Vol. 13, 1938, p. 579-581. Attempts in the past to produce ductile aluminum-coated steel failed due to lack of appreciation of certain fundamental characteristics of aluminum, as well as of steel. Aluminum has a very decided affinity for oxygen, even greater than that of silicon; aluminum likewise readily reacts with a host of other elements and the compounds thus produced seriously interfere with the attainment of a satisfactory aluminum-coated wire. A fundamental step in the Alplate process is the special preparation of the steel, or other metal surface as well as the careful control of the aluminum bath in order to insure a perfect interaction and bond between the two metals. Not only must the steel surface be carefully refined, but it must be thoroughly prepacked with a gas, preferably hydrogen.

The steps in the coating procedure are as follow:

The wire leaves the reel, passes through electrolytic cleaners, washers and driers, thence into a hydrogen furnace which serves a two-fold purpose, (1) of prepacking the steel furnace with hydrogen and (2) of purifying the steel surface eliminating carbon, as for example, CH_4. After the hydrogen treatment, the wire passes directly into the molten aluminum bath and thence through a wiper if specified onto the receiving reel. Usually before fabricating, the wire is given a special anneal following the coating step.

The product obtained is a steel wire with a bright, silvery uniform coat of aluminum with a strong intermediate bond of aluminum-iron alloy. Alplate wire is very soft and ductile and can readily be drawn, woven and otherwise fabricated into a wide diversity of wire products. Alplate wire is not only highly resistant to corrosion, but it will resist oxidation and embrittlement at elevated temperatures almost indefinitely. On this basis Alplate wire serves as a low-cost, practical electrical resistor.

Antimony Electrodeposits. Die Metallwaren-Industrie and Galvano-Technik. Question No. 2733, 1938, Vol. 36 No. 15, page 332.

Heavy antimony electrodeposits are seldom produced as they are usually merely used for metal coloring in contrast to arsenic which is frequently deposited in heavy coatings. Antimony deposits from chloride solutions are frequently explosive and if scratched, will give off a white smoke with a noticeable evolution of heat. These explosive deposits are characterized by their silver white brilliant color while the non-explosive deposits are mat gray. The explosive nature of antimony deposits is attributed to the halogen content which may be as high as 6%. The deposition of explosive antimony is dependent upon the concentration and temperature of the electrolyte and for example, the antimony will deposit in a non-explosive state when the chloride solution is 10% and the temperature is above 23° C. (73°F.) and from a 21% solution when the temperature is above 50°C. (122°F.). Numerous baths with relatively low efficiency and which give coarse deposits have been recommended in the literature and in recent years the solution recommended by Mathers has been found to be most practical for the deposition of antimony. This solution is composed as follows:

Antimony trioxide	60	g./l.
Hydrofluoric acid 48%	114	g./l.
Aloin	0.25	g./l.
Oil of cloves	0.012	g./l.

A rubber or lead lined tank should be used because ceramic materials would be attacked by the fluorides in the solution. The bath operates with almost 100% cathode efficiency at current densities up to 7 amps/ft.^{2} and soluble anodes can be used with the bath as they dissolve with high efficiency in this solution. Without addition agents the deposits are coarsely crystalline but with the above-mentioned addition agents, the deposits are finely crystalline, smooth and gray. The recommended quantities are sufficient for a 12-hour run after which 0.25 grams of aloin must be added.

Post Scripts

Foreword

It is planned herewith to conduct a human interest column giving personal notes about people in the metal finishing and metal working fields. These items may be personal experiences, anecdotes, association activities, etc., which carry a greater personal appeal than a mere citation in the Personals column.

The success of postscripts will depend upon the cooperation of our readers and we are asking at this time your cooperation by sending in items of interest about your associates or yourself. Photographs are particularly welcome.

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An Expression of Gratitude

The many letters of congratulation and assurances of cooperation received by the Editor during his matriculation into the Editorship of METAL INDUSTRY, have been heart warming and leave a feeling of gratitude difficult to express. To the many well-wishers who expressed a bon voyage in my new position and also to those not articulate in their expression, may I say, "Thank you", and express the hope that your expectations will be fulfilled.

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The Newark Branch of the A. E. S. and particularly *Horace Smith,* General Chairman, of the Second International Conference, gave gargantuan sighs of relief when the Hitler mess was settled without war. If war resulted, *Walter Barrows* of Canada, would prevent "International" from being a misnomer. While we are on the subject of the S. I. C., the Convention facilities at Asbury Park were inspected by the Research & Convention Committees on September 17th and the pre-view of a beautiful hotel, spacious Convention Hall and a rolling surf made us wish the Convention were next week.

The Educational Committee under *G. B. H.,* has already lined up some excellent papers and negotiations are under way with authors in England, France and Germany.

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That Bristol, Conn. plater who claims that he can't plate during full moon and goes fishing, presents a new reason for plating failure that defies a scientific explanation.

Someone expressed the thought a short time ago that it would be interesting to list fathers and sons engaged in metal finishing. To start the ball rolling here are a few:

Philip Sievering and sons, *Oliver Sizelove* and *Robert, Patrick Sheehan* (deceased) and *Vincent J.,* the *Hodecker* family and sons, *George Hogaboom* and sons *Byron* and *Ovide, Edward Faint* and son *Harold, Ken* and *Ben Kusterer, Ray Goodsell* and son, and *William Gray* and son. Some fathers go back to Civil War days as for example, *"Bill" Stratton's.* Send in your father and son teams.

When work is spoiled (very seldom) in *Tom Slattery's* plating department at the Bureau of Printing and Engraving, an order from the Secretary of the Treasury, Henry Morgenthau, Jr., is required to plate replacement work. This is so that money or stamp dies don't get in the hands of the wrong people.

Tom, in our opinion, possesses the finest tenor voice in the A.E.S. and in addition, is not stingy with his talents. His rendition of Irish ballads are *objet d'art* whether in formal presentation or in convivial harmony.

NO—THEY ARE NOT MAINE GUIDES

The big fellow on the left end is Bob Leather, the husky guy in the middle is George Knecht and the dandy on the right end (with a new mustache) is Ray O'Conner. Taken in the Canadian Wilds.

International Nickel Company's *Dr. W. A. Wesley* has a list of research projects which should be interesting to students of electrodeposition. It is our hope that research workers in electrodeposition especially in Universities will take notice. Far too much useless work on complicated ternary and quaternary alloys has been done when there is such an urgent need for a study of simple solutions.

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It was a pleasure to be able to see Zapon's *John Oberender* and Maas and Waldstein's *George Karl* boasting of their health at the Bridgeport Outing, as both men in recent months, have recovered from distressing illness.

United Chromium's *Henry Mahlstedt* evidently finds it difficult to distinguish dentists from electroplaters. Henry sat in at a dentist's conference under the impression that he was attending the September open meeting of the Newark Branch of the A. E. S. The friendly greetings you received, Henry, were part of the dentist's approach to a prospective customer.

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A suggested remedy for "spotting-out" of plated castings is to place them in a vapor degreaser for 5 minutes. Reports on the efficacy of this treatment or other suggestions on spotting out will be welcomed.

Fears were felt by *Dr. W. Blum* and other American friends for the safety of *Dr. Jean Billiter*, Austrian author of "Prinzipien der Galvanotechnik" during the "strong-arm" Anschluss of Austria by Germany. Dr. Blum reports that he has heard that Dr. Billiter and charming Madam Billiter are safe in France for which we are all truly grateful.

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Panels of hot galvanized and zinc electroplated steel exposed at Sandy Hook, N. J., and Pittsburgh, Pa. for six years, indicate that for equal thickness the electroplated coatings were superior in rust resistance to hot galvanized coatings. The rust on the hot galvanized coatings may be due, however, to the oxidation of iron in the $FeZn_{10}$ zone rather than indicating attack of the basis metal.

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To *Vincent Sheehan*, somewhere in Wisconsin, you were right at the Milwaukee Convention—Coleridge wrote Kubla Khan—not Browning.

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At the recent meeting of the Research Committee in New York, the automobile interests were represented by *Carl Huessner* of Chrysler and *W. Phillips* and *A. B. Wilson* of General Motors. Each of these men took an active part in the discussion on corrosion of plated coatings. Automobiles are excellent "guinea pigs" to try out plated coatings and we always listen carefully to their words of wisdom.

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NOTES FROM THE ROCHESTER MEETING OF THE ELECTROCHEMICAL SOCIETY

The extra-cheerfulness at Rochester of *Miss Isabel Johnson*, Asst. Secretary of the Electrochemical Society was due to anticipation of her marriage to *Dr. C. F. Bonilla*, Associate at Johns Hopkins and well-known contributor to the Society's transactions. The members sincerely regret her resignation on October 28th as assistant secretary after rendering such splendid service but they all join in wishing her and Dr. Bonilla success and happiness in their marriage which took place October 29th.

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The members attending the electrodeposition sessions would make an excellent "Who's Who" in this field. Some of the prominent members present were: Prof. E. M. Baker, Dr. A. Kenneth Graham, Dr. Wm. Blum, Prof. F. C. Mathers, F. Mesle, A. E. Thurber, Dr. Gustave Soderberg and L. R. Westbrook.

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The Rochester local committee headed by *T. J. Zak* of Bausch and Lomb Optical Company did an excellent job in planning the convention and well deserved the citation of thanks by Pres. Robert Baldwin.

Dr. Shelton of the U. S. Bureau of Mines offered an electrolytic method for refining manganese which he believes could be used, in time of war, to supply the United States with manganese from our own low-grade ores. Almost all of our manganese is now imported.

Dr. L. C. PAN

Dr. L. C. Pan's paper "Ammonia in Brass Plating Solutions" was sent from Shanghai, China, after the attack by the Japanese and he must have made full use of his "oriental serenity" to prepare such a valuable and comprehensive paper under such trying circumstances.

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Dr. William Blum and *Professor Colin Fink*, as usual, were the foremost contributors to the discussion on technical papers. Their discussions merit our admiration, and we wonder how they can possibly know so much about such diverse subjects.

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JOTTINGS AT THE DETROIT METAL SHOW

R. L. DeGaynor's beautiful rapid landscape paintings using spray guns attracted large crowds to the Binks Manufacturing Company's booth. In addition to being an artist, Mr. DeGaynor is an engineer, a violinist, and has aspirations to be a singer.

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Two well-known former contributors to the science of electroplating, *Dr. H. K. Work* and *W. E. Bancroft*, presented papers at the technical sessions. Dr. Work who is a manager of research for Jones and Laughlin Steel Corporation, Pittsburgh, co-authored a paper on metallography of steel, and Mr. Bancroft, metallurgist for Pratt & Whitney Company, Hartford, Conn., co-authored a paper entitled, "Machinability of Tool Steels". Dr. Work's former contributions on electroplating of aluminum and Mr. Bancroft's on hard chromium plating, are still highly valued.

"Superfinishing" of automobile moving parts by honing with carborundum was demonstrated by The Profilometer, a new tool for measuring surface roughness. This instrument can detect minute differences in roughness of surfaces to give a quantitative evaluation of polishing effectiveness.

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D. N. Eldred, DuPont's representative in California was present and reported that the electroplating industry is quite active on the Pacific Coast. The A.E.S. branches have good attendance at their meetings and would like to have more speakers from the East visit them.

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Some of the plating celebrities observed prowling around the Metal Show were: *Paul Strausser*, Research Associate at the Bureau of Standards; *T. C. Eichstaedt*, J. C. Robinson Co., Detroit; *Nathan Promisel*, International Silver Co., Meriden, Conn.; *Dr. H. P. Coats* and *J. F. McDowall*, Firestone Steel Products Co., Akron Ohio; *John J. Landy*, *Clayton Hoff* and *Floyd Oplinger*, DuPont Co.; *Frank Savage*, C. G. Conn Ltd., Elkhart, Indiana; *C. T. Thomas*, Bureau of Printing and Engraving, Washington, D. C.; *John S. Thompson*. Parker-Rust Proof Co., Detroit; *M. M. Mayers* and *Frank Watt*, Frederic B. Stevens Co., Detroit; *Carl Huessner*, Chrysler Co., Detroit; *Paul Amundsen*, Bright Nickel Corp., Detroit; J. W. Dammers, G. S. Blakeslee & Co., Cicero, Ill.; *George Geiger*, International Nickel Co., N. Y.; *George Spencer* and *G. E. Huenerfauth*, Crown Rheostat and Supply Co., Chicago; and *W. W. Davidson*, *G. W. Walter* and *Dave Willard*, Detroit Rex Products Co., Detroit.

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It was estimated that more than 20,000 delegates attended lectures, forums, and paraded through four acres of exhibits at Convention Hall. The exposition this year, with 265 exhibitors, was the largest yet held, outdoing last year's exhibition by 25 percent.

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ON THE DETROIT TROLLEY CARS. I have traveled on hundreds of trolleys, trains, busses et cetera throughout the United States and Europe but the Detroit trolley cars rank first in riding adventure. The seemingly misanthropical motormen start with jerks calculated to floor the unwary passengers and stop with a suddenness sufficient to shake loose even the alert passengers from their grips on hangers or friendly posts. Riding on Detroit trolleys is an experience long to be remembered and can be classed with a ride on a roller coaster or wrestling with a steer. The serenity of native Detroiters to trolley riding is amazing.

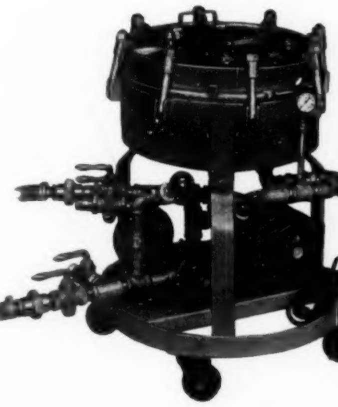
Walter R. Meyer

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Horizontal Plate Filter

The Sparkler Mfg. Co., 1210 Webster Ave., Chicago, Ill., has developed a horizontal plate diatomaceous earth filter. This filter is especially adaptable to modern powder filtering. The plates are designed to build up an unusually thick filter cake, and to hold the cake in a horizontal position within an enclosed chamber. This requires less time for pre-coating, gives better and more uniform quality, and permits intermittent operation of the filter without disturbing filter cake.



Horizontal Plate Filter

There is a minimum of waste of liquid being filtered because the filter can be drained dry before cleaning without mixing powder slurry with residue liquid.

The plates are so arranged that paper, cloth or wire cloth may be used. The filter also may be used as an asbestos disk filter if this method is found expedient.

This filter is reported to be ideal for the filtering of electroplating solutions as it can be made in stainless steel and because, as a diatomaceous earth filter, it has a very large capacity and flow rate.

It is made entirely of stainless steel, bronze, aluminum or steel. It is mobile and is readily adaptable to various liquids. Capacities range from 50 to 5,000 gallons per hour.

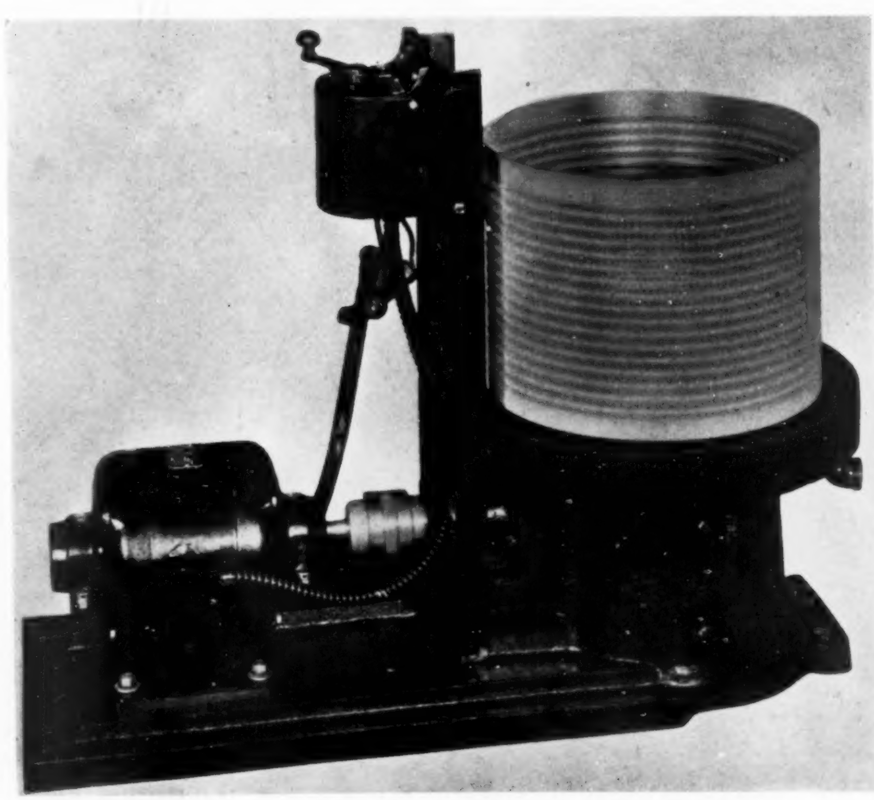
Sparkler horizontal plate filters using filter aids are also used for filtering heavy liquids such as waxes, varnishes, shellac, and syrups. It is claimed that filtration is so sharp that powder is now used for germ proofing.

Electric Drying Unit

Marked improvement is claimed to be effected in centrifugal drying of metal products and parts by a new development in the Mercil type centrifugal dryer made by the Hanson-Van Winkle-Munning Co., Matawan, N. J. As shown in the illustration, the new construction includes a Garden City blower, directly connected to a ¼ H.P. motor. A 6" pipe line is welded to the cover and extends over to the blower to a point where it can swing out in a horizontal position. The cover is simply lifted and swung out of the way in order to load and unload the basket of work. Electric heating elements are inserted in the pipe line directly above the opening in the cover.

The effect of this combination of Mercil dryer and electric drying unit is to dry a batch of 30 to 60 pounds of small work in one or two minutes.

An interesting feature of this unit is the absence of vibration even with the loaded baskets spinning at 600 R.P.M.



Electrical Centrifugal Dryer

Water Soluble Hydrocarbon

A new type of water soluble hydrocarbon known as Quaker TF-936, has according, to its manufacturers, the Quaker Chemical Products Corp., Conshohoken, Pa., the ability to remove all types of fats and soaps in addition to mineral oils. It is recommended for the processing of metals prior to painting, japanning, parkerizing, bonderizing or similar finishing or semi-finishing operations. It is said to produce a more freely rinsed, cleaner surface, insuring an adequate bond between the material and the finish. It can be used in either tanks or washing machines although preferably in the latter. No alkali or alkali salts are used, which eliminates the danger of a white deposit building up on the work.

Rubber-Lined Filter Press

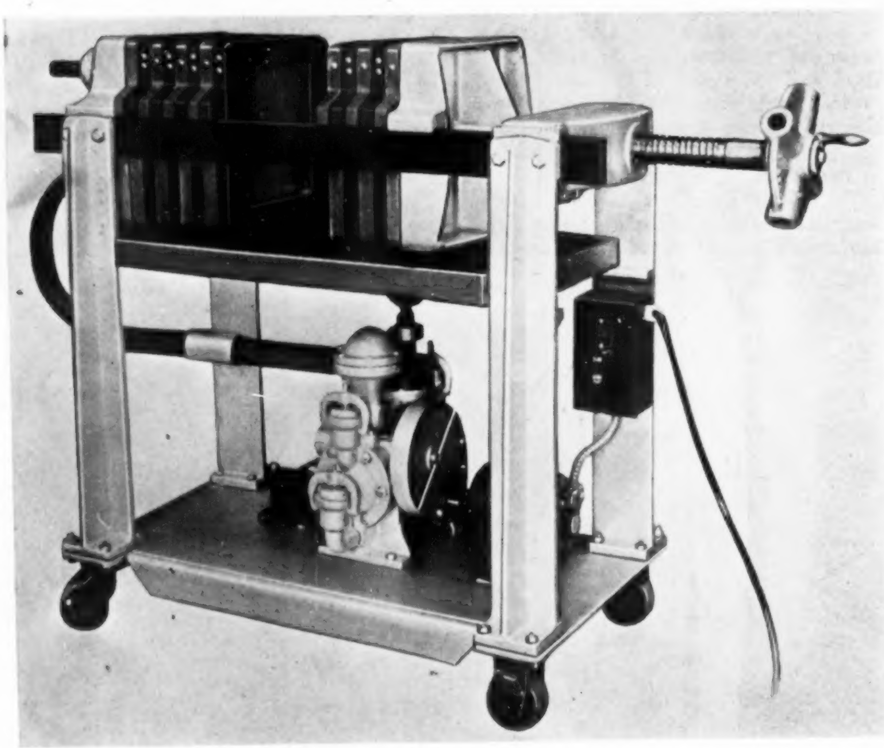
T. Shriver & Co., 808 Hamilton St., Harrison, N. J., have developed a new compact filter unit for filtration of electroplating solutions which are injurious to or are contaminated by metals. The operating mechanism of the filter is made of semi-hard rubber, thereby making it particularly useful for such solutions as bright nickel, acid copper, cyanide copper and sodium and potassium cyanide silver solutions.

The particular unit illustrated consists of alternate filter plates and frames, 12" square, assembled on side bars to make a 6 chamber filter with a total filtering area of 5.5 square feet and a conservative filtering capacity of 135 gallons per hour. Increased filtering capacity may be accomplished by adding plates and frames to increase the number of filter chambers at an increased rate of 20 to 25 gallons per chamber.

The plates are clothed with either cotton, twill or wool cloths depending on the nature of the solution to be handled. In order to facilitate cleaning, filter paper is placed over the cloth, thereby permitting quick and easy stripping of the paper together with the solids in the filter frame from the cloth and re-covering with fresh paper. The entire opening, cleaning and closing procedure is thus accomplished in minimum time.

The filter is fed by a Shriver Duplex Diaphragm Pump with rubber lined liquid ends, valves, feed and discharge with rubber hose connection to the filter. The pump is directly connected to a ¼ H.P. standard motor.

All this equipment is mounted on a portable stand, moved on heavy swivel type casters. The entire unit is only 35" long, 21" wide and 36" high.



Shriver Rubber-Lined Filter Press

New Vapor Cleaner

Magnus Chemical Company, Inc., Garwood, N. J., has just issued a new descriptive folder on its new product, Magnus Vapor Cleaner.

Magnus Vapor Cleaner is claimed to be made to give the greatest effectiveness and speed to steam or vapor cleaning, combining the principles of soap washing with solvent cleaning. The combination of the two, results in faster and more thorough "cutting" action than is found when either is used alone.

This new product is offered in two grades—Magnus 92-E for light duty cleaning; Magnus 94-E for heavy duty cleaning. Both are light brown pastes, quickly and readily soluble in water. They impart to the water a wetting, penetrative and solvent effect beyond that of any soap or alkali.

Magnus Vapor Cleaner is designed to function satisfactorily in any make of steam or vapor cleaning machine, such as the Hy-Pressure Jenny, the Kerrick Kleaner, the Circo Cyclone cleaner, the Ofelt, the Eclipse and the Star.

New Universal Spring Coiling Machine

Sleeper & Hartley, Inc., Worcester, Mass., manufacturers of wire working machinery and wire mill equipment announce the development of a new wire coiling machine, reported to possess many features which result in increased economy of manufacturing.

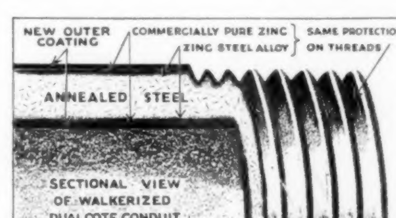
In case of a change or special spring, both pitch and diameter cams may be shaped, timed and affixed to the cam-hub which, as an entire single unit, may be removed from the shaft. One-piece solid cams may be used on this removable cam-hub. Other convenient controls include: individual pressure for each pair of feed rolls; individual simple adjustment for cutter alignment instantly adjusted from upper to lower cutter shaft; micrometer adjustment of compound blocks and pitch-stop conveniently located and quickly adjustable.

This machine will coil and cut all kinds of compression and extension springs including: open and close-coiled springs; right and left hand springs tapered one or both ends; two-diameter springs, coned springs with any degree of taper; coned springs with variable pitch; barrel-shaped springs; lays one or more close-wound coils at one or both ends of any type of spring.

Special tooling may be applied for use of square or rectangular wire.

New Conduit Finish

A new development in protecting steel conduit from corrosion has recently been announced by Walker Brothers, Conshohocken, Pa. By a new process known as "Walkerizing," a uniform coating of zinc is fused into the outside and inside walls of the steel tube. Over this is applied a second coating containing a new, inert substance, which offers strong resistance to acids, alkalies and salt water.



According to the manufacturer, this new conduit may be used to advantage, not only in industries and locations where chemical conditions create serious corrosion problems, but to assure longer service in all types of installations.

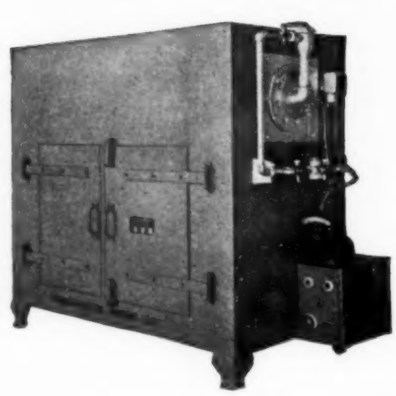
It is claimed that "Walkerizing" is an improvement on the Sherardizing process. The zinc covers the steel surface uniformly, alloying with it to form a coating which will not crack or chip and is well suited to holding the second protective coating.

Gas Fired Oven

Despatch Oven Co., 622 Ninth St., SE., Minneapolis, Minn., announces a new "CF" Despatch gas fired oven. This unit has an operating range from 225° to 950° F., and is very heavily insulated.

A novel feature is the horizontal air travel which is used instead of the customary vertical air flow system. The horizontal system permits heavier loading of the parts into the oven, it is stated, and produces more uniform results.

The oven it is claimed is also very speedy. The gas heating system is incorporated into one compact unit, outside of the working chamber and a fan is used to push heated air through the load.

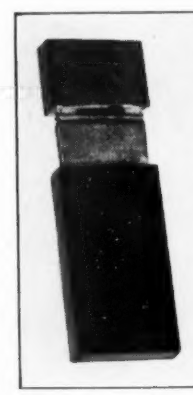


Despatch Gas-Fired Oven

New Protective Against Corrosion

A new protective against corrosion called Co-Res-Co has been announced by the Corrosion Control Corp., 26 Broadway, New York, on which basic patents are pending, for the protection of steel and other metals and wood against the destructive forms of corrosion. Applied by dipping, brushing or spraying, Co-Res-Co is claimed to offer unusual protection against extreme atmospheric corrosion, salt air, salt water, acid fumes, dilute acids and alkalies, as well as many other forms of corrosion.

Tests conducted in which steel, coated with Co-Res-Co was immersed in sea water and in a 12% salt water solution for more than 4,000 hours shows no attack; also, immersions in 10% solutions of nitric, sulphuric and hydrochloric acids respectively for more than 2,000 hours, as well as immersions in other acids and alkalies, show no attack whatever. Co-Res-Co also protects aluminum against a 10% solution of sodium hydroxide.



Co-Res-Co, it is stated, has successfully protected steel from acid fumes; pipes, etc., from brine, condensation, acid fumes in packing houses and refrigerating plants; scrubbing tanks in air conditioning units from alkaline solution; wood and metal ventilating hoods and ducts from chromic acid fumes and pickling fumes, as well as protecting against many other corrosive agents. Co-Res-Co withstands a dry heat temperature of more than 600° F., and a liquid temperature of approximately 150° F. It is produced in olive green and black colors, dries in 24 to 48 hours with no applied heat and provides a coverage of approximately 600 sq. ft. to the gallon. No prior treatment of the metal is necessary other than the removal of mill scale, loose rust, loose paint and grease. Where sand blasting is not possible, the use of a rotary wire brush is recommended for cleaning the metal. The accompanying photograph illustrates the extent to which Co-Res-Co protects a heavy steel bar from the destructive force of dilute nitric acid. The acid has reduced the uncoated section, which was exposed, to less than half of the original thickness, while the coated section, which was exposed to the acid, is completely protected.

New Spray Gun

Burning Brand Co., 1408 W. Fulton St., Chicago, Ill., announce their newest production spray gun which has a new feature, a 3rd needle valve. When the button is pressed the spray automatically changes to round in a split second, and when button is released again, the spray goes back

Three Needle Valve Gun

to its original fan width. A sprayman can skip around from fan to round without making adjustments with this new gun.

The gun is extremely light and is finished in chromium plate. Burning Brand Co. has just issued new literature which is sent on request.

Special Metallic Center Abrasive Wheels

The Ever-Tru Abrasives Wheels, Inc., 145 Hudson St., New York City, announce the development of patented abrasive wheels containing metallic centers with wire mesh inserts. The metallic centers with elastic woven wire mesh of special alloy spring steel lying in the center of the grinding wheel are claimed to accomplish automatic centering and balancing with a corresponding decrease in pressure required, which results in improving work of wheel grain and decreasing the normal fatigue of the workman from shaking and vibrating action. The abrasives can be used down to the metallic center and the centers can be used over and over again with the abrasive simply and quickly replaced.

High-Speed Copper Plating

A new high-speed copper plating process has been announced by E. I. duPont de Nemours & Co., Inc., Electroplating Division, Wilmington, Dela., which is claimed to enable plating four times as fast as by ordinary processes, with 100% cathode efficiency even at high current densities. The deposits are reported to be uniformly bright, free from pits and other imperfections, and that heavy coatings .001" to .003" can be obtained in 10 to 20 minutes. The deposits can be easily buffed as they are reported to possess a fine grain structure and hence are suitable for deposition of both bright and dull nickel. The duPont high-speed copper plating process can be installed in the usual cyanide plating equipment and the solution is prepared from pure compounds, which are completely soluble in water. High purity copper anodes are required and these remain bright and clean throughout the entire plating operation without sludging or polarization.

As a result of the high efficiency of the process, hydrogen and obnoxious fumes are avoided and cyanide decomposition is negligible.

For some articles, such as printing rolls, wire, rods, the process can be adapted to a current density of 100-200 A/SF. This heavy current deposits the copper very rapidly. Heavy weight smooth and bright coatings can be obtained to almost any desired thickness.

Rust Preventive Coating

Densoxcide, a rust preventive coating, developed by the Densol Paint Company, Box 34, South Park, Ohio, is recommended for use on interior and exterior surfaces, where corrosion and rust already have occurred or are likely to occur. According to the manufacturers it is not necessary to clean the surface thoroughly to which Densoxcide is applied but merely to wire brush it lightly. This material can also be used as a primer. It does not dry absolutely hard but remains slightly tacky and any elastic finish can be safely applied over it after it is dry.

Low-Cost Resistance Welding Process

General Electric Company, Schenectady, N. Y., have developed a low-cost resistance welding process of an electronic type to replace expensive soldering operations in the manufacture of such devices as radio sets, watches, small meters, industrial control devices, railway signal equipment, and business machines.

A current of several thousand amperes flows in the secondary circuit of the welder for a half-cycle which is precisely timed by an Ignitron tube and its associated control circuit. This control circuit includes a dial for regulating the heat by the phase-shifting method. The amount of heat is accurately determined by the duration of current flow; maximum heat is obtained with a current duration of slightly more than 1/120 of a second. The welding transformer and its associated equipment are suitably enclosed.

G.E. Welder

Portable Brush Electroplating Outfit

The Portable Plating and Equipment Company, 1000 S. Michigan Ave., Chicago, has recently announced a new portable unit for plating metal. This Company for the last two and a half years has been selling brush electroplating equipment to railroads, hotels, utilities, and manufacturing concerns. From these large industrial machines comes the development of a smaller, more compact unit (called "Super Plater") for the home, workshop, or small commercial establishment.

Portable "Super Plater"

Preventing Adhesion of Welding Spatter

No. 2 Metal Coating made by Wayne Chemical Products Co., Copeland and M. C. R. R., Detroit, Mich., is a white pigmented water soluble compound for application in flash welding to keep jaws of welding machine from "loading" with spatter.

The usual method of scraping this spatter which accumulates on the jaws is overcome by spraying of said jaws with above preparation which quickly forms a tough coating to which the spatter will not bond. The length of time which "one spraying" is effective depends on both the thoroughness of application and type of work. As the coating, when dry, is more effective, it is advisable whenever possible to allow time for drying or to speed drying with air hose or other simple means. A large body plant reports 70 to 75 welds between applications; their former practice was to clean jaws every 12 to 15 welds.

Aluminum Sparkle

A fine wave line wrinkle finish with glistening silver effects, called Sparkle Rip-pl, is offered with finishing materials furnished by Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.

The metallic effects are obtained by adding a brilliant coarse aluminum powder to the wrinkle finish material, mixing the material thoroughly and then reducing the Sparkle Rip-pl, 7 to 1 with naphtha. A full even coat is sprayed on and then baked for 1½ hours at 200°F. This material is available in several attractive colors.

The Sparkle Rip-pl may be used on any non-porous surface and is well suited for use on heating and air conditioning equipment, toys, novelties, etc. Finish is said to be proof against alchohol, grease; also moisture and oil-proof.

Manufacturers' Literature

Zinc Alloy Die Castings in Industrial Equipment. Applications are pictorially shown for zinc base die castings used in industrial equipment. New Jersey Zinc Co., 160 Front St., N. Y. City.

Magnesium Alloy Castings. The physical properties of Magalloy, as well as applications for these alloys are given in detail. The physical data are particularly valuable. Magnesium Fabricators, Division of Bohn Aluminum & Brass Corp., Adrian, Mich.

Bearings, Bushings. A discussion of industrial applications of bearings, bushings and bearing metals. Federal-Mogul Corp., Detroit, Mich.

Automatic Machinery. Catalog describing automatics for threading, grinding and wire forming. The Baird Machine Co., Bridgeport, Conn.

Roll Grinding. A comprehensive booklet describing the various factors to be considered in roll grinding, such as type of wheels to use, size of wheel, wheel life, balancing, centering, etc. Norton Co., Worcester, Mass.

Disc Grinding. Applications and operating data for disc grinding. Norton Co., Worcester, Mass.

Roller Chains and Sprockets. Catalog No. 333 includes list prices and dimensions of standard and non-standard roller chains, stock and made-to-order sprockets; also engineering information on the selection and application of roller chain drives. Chain Belt Company, 1600 W. Bruce St., Milwaukee, Wisc.

Abrasive Wheels for Thread Grinding Machines. A discussion of the basic principles involved in connection with wheel action in thread grinding, operating speeds, types of bonds, grain size, truing, and dressing of wheels, coolant and other pertinent subjects are discussed. Norton Co., Worcester, Mass.

Annual News Letter. Silver Jubilee Year. All Industrial Sections. National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill.

New Cleaner. Literature on Anodex, a new cleaner for steel and copper-plated parts. MacDermid, Inc., Waterbury, Conn.

Cutting Fluids. Illustrated booklet giving comprehensive presentation of cutting fluids and their applications, from light automatic screw machine work to heavy broaching for non-ferrous and ferrous metals, manufacturers and machine tool builders. Tide Water Associated Oil Co., Tide Water Div., 17 Battery Pl., N. Y.

Metallic Finishes. "Hilo Metallic Rip-pls", giving an attractive wave line effect and a metallic sheen in one coat, for use on any non-porous surfaces and fairly smooth metal without the use of priming, sanding and other preliminary preparations. Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.

Monel, Nickel and Nickel Alloys. "Methods for the Fabrication of Nickel-Clad Steel Plate". Bulletin T-4 revised as of September 1938; also "Properties and Uses of Inconel". Bulletin T-7, revised as of August 1938. Development and Research Division, International Nickel Co., Inc., 67 Wall St., New York.

Quarterly Price List. R & H Chemicals, E. I. duPont de Nemours & Co., Inc., Wilmington, Dela.

Zinc Alloy in Hardware Die Castings. A well illustrated booklet describing the uses and applications of zinc base alloy die castings for various types of hardware, such as automobile, stove, household, bicycle, etc. New Jersey Zinc Co., 160 Front St., N. Y. City.

Technical Publications

Determination of Lead in the Air. Preventive Engineering Series, Bulletin No. 2, Part 6. Air Hygiene Foundation of America, Inc., Pittsburgh, Pa.

Identification of Industrial Dusts. Preventive Engineering Series, Bulletin No. 2, Part 7. Air Hygiene Foundation of America, Inc., Pittsburgh, Pa.

Copper and Brass Research Association. Bulletin No. 100, October 1938. Copper & Brass Research Association, 420 Lexington Avenue, New York.

Cadmium Plating on Steel. Oakite Products, Inc., 22 Thames St., New York City.

New Books

Chemical Engineering Catalog. Twenty-third Annual, 1938 Edition.

In keeping with the past editions of this valuable catalog, the printing and cuts are beautifully done. The book has been enlarged to 1034 pages, and is well indexed. The technical data section has been enlarged and contains charts on humidity, vapor pressures, heat transfer co-efficients and many other valuable physical chemical data.

Steel Construction. By Henry Burt & C. H. Sandberg. Published by American Technical Society. Size 5½" x 8¼", 428 pages. Price $3.50.

The fourth edition of this book is thoroughly revised to bring it up-to-date. The revision includes specifications, data and many photographs and drawings. The material has been re-arranged into chapter form to make it more convenient for use and additional chapters have been written on several subjects, such as, welding and industrial buildings. It is an excellent text for students as it gives the theory on which are based the facts and formulae needed in designing structural steel framework for buildings.

Metallurgy. By Johnson, Dean and Gregg. Published by American Technical Society, Chicago, Ill. Size 5½" x 8¼", 144 pages. Price $1.50.

This splendid little book on general metallurgy is printed in a "How To Do It" style. It discusses almost every fundamental question in metallurgy and is simply and clearly written for the non-professional metallurgist.

The illustrations are well chosen and clear and the book is thoroughly indexed and bound in a beautiful water-proof cover.

The theoretical aspects of metallurgy are only lightly touched, but the subject matter suffices to present a clear story of both physical metallurgy and technical metallurgy. Some of the chapters are: Properties of Metals; Testing of Metals; Manufacture of Iron and Steel; Physical Metallurgy; Shaping and Forming Metals; Alloy Steel and Powder Metallurgy.

The book is recommended to plant foremen, platers, purchasing agents, and as a book of elementary metallurgy.

Gas Content Control in Nickel Wire

Because the gas content of nickel wires is an important factor in incandescent lamp life, the Driver-Harris Co., Harrison, N. J., has developed means for accurately controlling the amount of gas released by its nickel wires when sealed in molten glass. The amount is determined by sealing a wire sample in a glass tube, and noting the entrapped bubbles.

For incandescent lamps, a low-gas content nickel is preferred, since released gas would attack and weaken the tungsten filament. With radio tubes, however, a gassy wire is preferred. The relatively larger diameter nickel-wire supports must be imbedded to a considerable depth in the glass press to withstand the strain of forming and of supporting the various elements of the stem mount. Also, the appreciable difference in expansion rate between wire and surrounding glass must be compensated for. Consequently, the cushioning effect provided by entrapped bubbles in the glass mass surrounding the imbedded nickel wires, is found desirable in minimizing glass strains and preventing cracking.

Associations and Societies

The Electrochemical Society

Metropolitan Section

The first meeting of the season will be held in Room 309, Havemeyer Hall, Columbia University, New York on Friday, November 18, 1938 at 7:45 P.M. Non-members are cordially invited.

Speaker: Dr. Walter R. Meyer.

Subject: "Solving Metal Coating Problems With the Aid of the Microscope."

The speaker has had wide experience in the field of metal coatings in this country and has made a tour of plants in several European countries. Until very recently he was chief metallurgist and electrochemist at the Bridgeport plant of the General Electric Co. He is now the editor of METAL INDUSTRY. The lecture will be illustrated with lantern slides.

Raymond R. Rogers, Secretary-Treasurer
Columbia University.

Porcelain Enamel Institute

Eighth Annual Meeting

The Eighth Annual Meeting and Sales Conference of the Porcelain Enamel Institute will be held in Cleveland, at the Hotel Statler, November 16 and 17. This meeting had previously been announced for October 25 and 26.

The Executive Committee of the Porcelain Enamel Institute decided to defer this meeting until November on account of the rapidly improving business in the porcelain enameling industry. If improvements noted at this time continue, the middle of November should see many branches of the industry operating at a favorable rate.

American Electro-Platers' Society

Philadelphia Branch

Annual Educational Session, Hotel Warwick, November 19, 1938. Educational session 2 P.M.; banquet 7 P.M. Tickets $2.75.

Educational program includes the following speakers:

Floyd Oplinger of the duPont Company—"Copper Plating from Cyanide Solutions".

B. G. Daw, vice-president of Lasalco, Inc.—"Practical Demonstration of What Happens in a Plating Barrel".

George B. Hogaboom of Hanson-Van Winkle-Munning Co.—"Color Finishing," with samples exhibited on display board.

New Haven Branch

At the October 13 Open Meeting of the New Haven Branch, *Austin B. Wilson*, former president of the A.E.S., metallurgical engineer in charge of fabricating and finishing of metals at the Chevrolet Gear and Axle Co., Detroit, spoke on electroplating and metal finishing in the automotive industry. Two interesting talking pictures were presented along with Mr. Wilson's lecture.

Thomas H. Chamberlain was chairman of the meeting and short addresses were presented by *Joseph Downes*, Remington-Rand Co., Middletown, Conn., and *W. J. R. Kennedy*, executive secretary of the A.E.S.

Detroit Branch

The annual educational session and banquet of the Detroit Branch will be held Saturday afternoon and evening, December 10th. The speakers will be *Dr. Oliver P. Watts*, Professor Emeritus Chemical Engineering, University of Wisconsin, Madison, Wisc. Subject: "Corrosion of Metals", and *Dr. Walter R. Meyer*, Managing Editor, METAL INDUSTRY, New York City. Subject: "Metallic Addition Agents and Impurities in Plating Solutions".

An additional feature of the educational session will be movies on a timely subject in the metal industry field.

Air Hygiene Foundation

The annual meeting of Air Hygiene Foundation will be called for Thursday, November 17, at Mellon Institute, Pittsburgh. The program includes progress reports on the Foundation's Research for preventing industrial disease and improving employee health. Other reports, for industrial management, will cover legal, economic and social phases of industrial health.

Connecticut Non-Ferrous Foundrymen's Association
Louis G. Tarantino, 670 W. Jackson Ave., Bridgeport, Conn.

The Connecticut Non-Ferrous Foundrymen's Association held a meeting on Tuesday, October 11th at the Indian Hill Country Club, New Britain, Conn., with a large attendance.

A Golf Tournament was held in the afternoon with prizes donated by Walter J. Kenney of North & Judd Mfg. Company, New Britain, and won by C. H. Blanchard of American Chain & Cable Company, Reading, Pratt & Cady Division, Hartford, Howard Gillis of Ansonia and Louis G. Tarantino of Bridgeport.

The evening meeting was presided over by President H. A. Phelps of Phelps Foundry Co., Ansonia. The speaker of the evening was T. Joseph Judge of Jenkins Bros. Co., Bridgeport, who spoke on the subject entitled, "A Common Non-Ferrous Problem". He displayed several castings illustrating the difficulty that is encountered with incipient shrinkage. On general discussion of the problem, it was the concensus of opinion that one corrective measure would be the raising of the cope thus increasing the pressure.

The November meeting will be held in New Haven on Tuesday, November 15th, and the speaker will be C. H. Stokesbury of Derby Castings Co., Seymour, Conn., on the subject of "Non-Ferrous Jobbing Castings".

Galvanizers Committee to Hold Its Fifth Meeting in Chicago

F. G. White, chairman of the Galvanizers Committee, has just announced that a meeting of this group will be held on November 17, 18 and 19, 1938, at the Palmer House in Chicago.

Two technical sessions are scheduled for Thursday, November 17. On Friday, November 18, the group will visit the Gary Sheet Mill of Carnegie-Illinois Steel Corporation and the galvanizing department of the Inland Steel Co. at Indiana Harbor. Saturday morning, November 19, has been set aside for a round table discussion and a short business session.

1939 Convention American Foundrymen's Association

Cincinnati has been selected as the place of the 1939 annual convention of the American Foundrymen's Association, with the meeting opening Monday, May 15 and continuing through Thursday, May 18.

The 1939 convention will be held without an exhibit and patterned after the successful technical meetings held in Chicago at the Edgewater Beach Hotel in 1927, and at the Royal York Hotel in Toronto in 1935. The entire program will be devoted to technical, management and general interest sessions, shop operation courses, round table discussions and committee meetings, plant visitation and social functions that add to the enjoyment of annual Foundrymen's Week.

Obituaries

William Robb Barclay

The British non-ferrous metal industry sustained a serious loss by the death, at the age of 63, of William Robb Barclay, on September 16th. Mr. Barclay was one of the leading metallurgists of England, and was an outstanding authority on non-ferrous metallurgy. His loss is also keenly felt in the United States because of his interest and work in electrochemistry as well as non-ferrous metallurgy.

Mr. Barclay's business and technical associations have been distinguished and he was an original member of the Institute of Metals. He was elected in 1936 to presidency of the Institute and in 1937 was re-elected to serve a further term.

Frank B. McMillin

Frank B. McMillin, president of the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, died at his home in that city on September 8, at the age of 69. Mr. McMillin became associated with the company in 1902 as a special auditor and advanced through the various managerial offices until he reached the presidency in 1935. He was active in community affairs and served as president of the Ohio State Chamber of Commerce from 1924 to 1933; president of the Manufacturer's Association of Central Ohio in 1924, and was a member of the committee on state and local taxation and expenditures of the United States Chamber of Commerce in 1932.

William A. Cowles

William A. Cowles, vice-president of the American Brass Co., Ansonia, Conn., died at the age of 79. Mr. Cowles began with Ansonia Brass & Copper Company in 1879 and became vice-president when that company merged with the American Brass Company. He was also president of the Ansonia National Bank, vice-president of the Ansonia Water Company and a director of the Derby Gas and Electric Company.

Raymond C. Raber

Raymond C. Raber, former manager of the McCord Manufacturing Co., plant in Walkerville, Ont., died of a heart attack September 26, aged 56. Mr. Raber was born in Stillwater, Pa., but lived in Detroit 35 years, working first for the McCord Company in Detroit, then in Walkerville. He was a Government tester of Liberty motors in the World War and for the last fourteen years was with the Fisher Body Division of General Motors.

Karl W. Nelson

Karl W. Nelson, sales manager of the plastics department of the General Electric Co., and formerly manager of the company's automotive products sales section, died suddenly in Pittsfield, Mass., on Oct. 16, aged 35 years.

Frank Terrio

The many friends of Frank Terrio, president of Lasalco, Inc., St. Louis, Mo., were shocked to learn of his death on Monday night, October 31st. Mr. Terrio had been engaged in the electroplating industry for over twenty-five years, and leaves a host of friends. He is survived by his wife, Grace, and a daughter, Irene. This news was learned as METAL INDUSTRY was going to press, and full details of Mr. Terrio's life will be published in the December issue.

Michael F. Barrett

Michael F. Barrett, founder and president, Cleveland Brass Manufacturing Company, died October 6th at his home in Cleveland. Mr. Barrett founded the company in 1892.

A. Werner Carlson

A. Werner Carlson, treasurer of the Gardner Metal Products Co., Gardner, Mass., died recently. Mr. Carlson was a native of Finland, and was associated with Gardner industries, of which his brother is president, for the past 35 years.

John R. Griffith

John R. Griffith, 56, of Norton Company's electric furnace plant at Chippewa, Ont., died September 6th. Mr. Griffith had been associated with the Norton Company since 1911.

Personals

Louis S. Cates Awarded Gold Medal

Louis S. Cates, President of Phelps Dodge Corporation was elected the William Lawrence Saunders Gold Medallist by the Board of Directors of the American Institute of Mining & Metallurgical Engineers, on October 18, 1938. This election was made on the unanimous recommendation of a committee of seventeen eminent engineers of which James MacNaughton, president of the Calumet and Hecla Consolidated Copper Company, was chairman.

In achieving this honor Mr. Cates joins the ranks of such illustrious engineers as the late John Hays Hammond, Herbert Hoover, Daniel C. Jackling, Walter H. Aldridge, Clinton H. Crane, Pope Yeatman, who are among those who have received the William Lawrence Saunders Gold Medal.

Perkin Medal Award

Dr. Walter S. Landis has been elected to receive the Perkin Medal of the Society of Chemical Industry for 1939. The medal is awarded annually for valuable work in applied chemistry and will be presented this year to Dr. Landis for his work on cyanamid, derivatives of cyanamid, fertilizers, ammonium phosphate in particular, the first commercial production of argon and contributions to the explosive industry. The selection is made by a committee representing the five chemical societies in the United States.

The medal will be presented on January 6, 1939, at a meeting to be held at The Chemists' Club, 52 E. 41st Street, New York City.

Dr. Jewett Chosen John Fritz Medallist

Dr. Frank Baldwin Jewett, vice-president of the American Telephone and Telegraph Company and president of the Bell Telephone Laboratories, has been awarded the 1939 John Fritz Gold Medal, highest of American engineering honors, for "vision and leadership in science, and for notable achievement in the furtherance of industrial research and development in communication".

The award is made annually for notable scientific or industrial achievement by a board composed of representatives of the four national engineering societies of civil, mining and metallurgical, mechanical and electrical engineers.

Dr. Jewett was born in Pasadena, Calif., Sept. 5, 1879. In 1898 he received the

bachelor of arts degree from the Throop Polytechnic Institute, now the California Institute of Technology, and in 1902 the Ph. D. degree from the University of Chicago. Following work as a research assistant to Professor A. A. Michelson of the University of Chicago, Dr. Jewett was an instructor in physics and electrical engineering at the Massachusetts Institute of Technology for two years until 1904.

From 1904 until 1912 he was associated with the American Telephone and Telegraph Company as transmission engineer. In 1916 he became chief engineer of the Western Electric Company after serving four years as assistant to that position. He was made vice-president of Western Electric in 1922 and since 1925 has been vice-president in charge of development and research of the American Telephone and Telegraph Company and president of the Bell Telephone Laboratories, Inc.

W. Stuart Symington has been elected president and general manager of the Emerson Electric Mfg. Co., St. Louis, Mo., succeeding Joseph Newman, who will continue as chairman of the board until January 31, 1939. Oscar C. Schmitt continues as vice-president in charge of fan and motor sales. Raymond E. Otto has been made manager of motor sales and John Wright, manager of fan sales. E. L. Splitstone has been appointed chief engineer.

Independent Air Filter Co., Chicago, announces the appointment of five new representatives for their Double-Duty, Kompak and Permo air filters. These appointments are: James L. Brown, 1824 Galloway St., Memphis, Tenn., Crawley-Gorbandt Co., 3450 Ivy Rd., N. E., Atlanta, Ga., Factory Sales & Engineering Co., 816 Howard Ave., New Orleans, La., K. J. Murray, 5722 N. 25th Ave., Omaha, Nebr., and W. A. Witheridge Co., 746 S. 4th Ave., Saginaw, Mich.

Gerald P. King

Mr. Gerald P. King, managing director of the British publications "Iron & Steel Industry," "Metal Industry," "Welding Industry" and others from London, England, has been a visitor in this country during the past two months making his headquarters at the METAL INDUSTRY office where he conferred frequently with our editorial staff.

Walter Fraine, past president of The American Electro-platers' Society, retired Foreman of Finishing at The National Cash Register Co., Dayton, Ohio, and former Associate Editor of METAL INDUSTRY has gone South for the winter to seek improvement in his health.

Chas. C. Conley has resigned from the National Cash Register Co., Dayton, Ohio, effective October 8, after having been associated with that organization for the past 15 years, in the Research and Plating Departments. Mr. Conley has accepted a position as plant manager with the Stolle Corporation, whose main office is located in Cincinnati, Ohio. Plants are located in Cincinnati, Dayton and Sidney, Ohio. Mr. Conley will be located at the Sidney plant where a new wing has been added and extensive installations are being made in order to handle an entirely new and novel line of work.

Kirke W. Connor, president of the Micromatic Hone Corp., sailed October 6th on the Queen Mary for a six to eight weeks trip to Europe. Mr. Connor will speak before several engineering groups on the subject of new developments in surface finishes. His audiences will include aircraft, production and automotive engineers in Great Britain. Visits will also be made to Micromatic dealers and users in England and possibly in France, Germany and Russia.

O. M. Gibson, formerly metallurgist at Dodge Brothers Corp., recently was appointed research director of G. S. Rogers & Co., Chicago, Ill., manufacturers of processing materials used in the heat treatment and finishing of steel machines and automotive parts. All production control and research laboratories of the company's Middle-West and Eastern seaboard plants will be under his supervision. Mr. Gibson, a graduate of the University of Detroit, formerly was field metallurgical engineer for J. B. Ford Company and later was manager of the metal-working research department at E. F. Houghton & Co., Philadelphia. For the last 15 years he has specialized in cost control as applied to heat treatment and general manufacture of automobile and machinery parts.

Lee M. Clegg, executive vice-president of the Thompson Products Co., Cleveland, and Dr. Zay Jeffries, president of the Carboloy Co., Detroit, have been elected members of the Corporation and the Board of Trustees of Case School of Applied Science, Cleveland.

David E. Anderson has resigned as chief engineer of the Bohn Aluminum & Brass Corp. of Detroit.

John D. Tebben, formerly manager of the Detroit office of P. R. Mallory & Co., Inc., Indianapolis, Ind., has been appointed sales manager of the metallurgical division at Indianapolis.

The appointment of *Edwin M. Sherwood* to an Ohio State University-Battelle fellowship in metallurgy is announced by Clyde E. Williams, Director of Battelle Memorial Institute. This fellowship is a part of the Institute's work in the field of research education. Mr. Sherwood is to make a study of the austenite-ferrite transformation in stainless steels and related alloys, applying electron diffraction and X-ray technique.

Mr. Sherwood is a graduate of Ohio State University and received his Master of Science degree in Physics from there in 1935.

Dr. Edwin M. Baker, Professor of Chemical Engineering at the University of Michigan, is enjoying a Sabbatical semester from his teaching. Dr. Baker has published extensive work on heat transfer, distillation, gas absorption and extraction. In addition to his work in the chemical engineering field, Professor Baker has published outstanding work in the field of electro-chemistry, and two of his works in this field are *Rust Resistance of Nickel Plated Steel*, written in 1924, and *Protective Value of Chromium Plate*, written in 1928.

In addition to his University activities, Professor Baker has been active in consultant work, particularly in the automotive industry.

Copper & Brass Research Assn. Elects Officers

Presided over by President F. S. Chase, the 17th annual meeting of the Copper and Brass Research Association was held October 22.

The following officers were elected:

President F. S. Chase, president of Chase Brass and Copper Co., Inc.; vice president, John A. Coe, president of the American Brass Co.; vice president, C. D. Dallas, president of Revere Copper and Brass, Inc.; vice president, Wylie Brown, president of Phelps Dodge Copper Products Corp.; treasurer, C. D. Dallas, president of Revere Copper and Brass, Inc.; secretary, Bertram B. Caddle.

Following are those elected to the executive committee:

J. A. Doucet, Revere Copper and Brass, Inc.; R. L. Coe, Chase Brass and Copper Co., Inc.; F. E. Weaver, the American Brass Co.; Wylie Brown, Phelps Dodge Copper Products Corp.; W. M. Goss, Scovill Manufacturing Co.; H. W. Steinkraus, Bridgeport Brass Co.

The board of directors elected includes the members of the executive committee and the following:

F. S. Chase, Chase Brass and Copper Co., Inc.; C. D. Dallas, Revere Copper and Brass, Inc.; John A. Coe, the American Brass Co.; R. E. Day, Bridgeport Brass Co.; J. P. Lally, C. G. Hussey and Co.; C. C. Limbocker, Wolverine Tube Co.; H. A. Staples, Phelps Dodge Copper Products Corp.; F. L. Riggin, Mueller Brass Co.; C. P. Goss, 3rd, Scovill Manufacturing Co., and Bertram B. Caddle, secretary of the Copper and Brass Research Association.

Dr. Robert M. Burns of Bell Telephone Laboratories, New York, has completed an exhaustive study of the "Protective Coatings for Metals," in connection with the preparation of a manuscript which will be published under that title as one of the American Chemical Society Monographs.

Dr. Burns is noted for his work on the mechanics and theory of corrosion, publishing many papers in this field. He recently took charge of the session on Corrosion and pH at the Rochester Meeting of the Electrochemical Society, and on October 7 addressed the Chicago section of the Electrochemical Society on the Mechanism of Corrosion, and Newer Trends in Protective Coatings.

Verified Business Items

Announcement was made this week of the formation of the Bright Nickel Corporation, incorporated under the laws of the state of Michigan. The Bright Nickel Corporation has purchased the American and Canadian patents for the bright nickel process formerly owned by the Schloetter Process Corporation, New York. It has also purchased the patents and patent applications owned by the Pyrene Manufacturing Co., Newark, N. J., and the Parker-Wolverine Co., Detroit, Mich. The officers and directors of the new company are as follows: Charles H. Awkerman, Detroit, president; Richard G. Auspitzer, Schloetter Process Corporation, vice-president; Luis E. Eckelmann, Pyrene Manufacturing Co., vice-president; W. M. Hawkins, Parker-Wolverine Co., Detroit, secretary-treasurer; and John Scofield. The company will engage primarily in licensing the "bright nickel" process to manufacturers using nickel plating as an intermediate or final finish. To handle the licensing, the Bright Nickel Corporation has made a sales agreement with a number of leading chemical firms. License to nickel platers will be granted through the Harshaw Chemical Company, Cleveland, the McGean Chemical Company, Cleveland, the Pyrene Manufacturing Company, Newark, the Seymour Mfg. Company, Seymour, Conn., and the Udylite Co., Detroit.

Lincoln Engineering Co., 5701 Natural Bridge Avenue, St. Louis, Mo., has let general contract for a one-story addition, 200 x 200 ft., for storage and painting. The cost will be over $60,000 with equipment. The company manufactures lubricating equipment, parts, etc. Departments: stamping, cleaning, plating, tumbling, burnishing, lacquering, finishing. Principal base metals used: steel, zinc and aluminum.

Stamping Service, Inc., 4833 Beaubien Street, Detroit, Mich., manufacturer of metal stampings, has let general contract for a new one-story plant on East Davison Avenue, Detroit, with office building adjoining. Cost over $40,000 with equipment. Departments: stamping and die making.

Pittsburgh Steel Co. has received a license from the Inland Steel Co. to produce its new lead-bearing steels. Inland first announced the development of lead-bearing steel in May of this year, under the trade name of Ledloy. The new lead-bearing steel has been produced by Inland in hot rolled form and cold finished by a number of cold drawing concerns. It is expected that Inland will license other steel companies in the near future.

Chain Belt Co., Milwaukee, Wisc., has announced the addition of a complete new line of screw conveyors and steel buckets. While the company has always made some screw conveyors and steel buckets, the complete rounding out of the line has been made possible by the acquisition of the machinery and drawings of the Weller Mfg. Co., Chicago. The manufacturing operations will continue in Chicago where the company is occupying 12,000 sq. ft. of floor space at 4425 W. Cortland St.

The Glenn L. Martin Company has completed and occupied a new building at its plant at Middle River, Md., to be used exclusively for its drop hammer department. The structure has a floor space of 10,000 sq. ft. and with its new equipment represents an investment of $75,000. The addition, which immediately quadruples the company's drop hammer capacity and provides for further enlargement contemplated at an early date, makes possible increased use of stamped parts in the manufacture of flying boats and bombardment aircraft.

Bridgeport Brass Co., Bridgeport, Conn., has asked bids on general contract for one-story addition, 110 x 220 ft., to tube mill on Housatonic Ave. Cost over $100,000 with equipment.

Johnston Tin Foil & Metal Co., 6106 S. Broadway, St. Louis, Mo., will soon award the contract for the construction of a 1-story, 100 x 100 ft. brick and concrete addition to its factory.

Advance Plating Co., Milwaukee, Wisc., has been incorporated by Edward J. Winkler, Emil M. Goralski and John J. Zisky, as permanent organization of business of galvanizing, tinning, etc., carried on at 516 W. Highland Avenue for some time.

Metal Market Review

October 27, 1938.

The price of *copper* advanced steadily during the month from 10⅜c to 11.25c and continued firm at the latter price. On October 15th, members of the European Copper Cartel announced that the production quota of its members would be increased from 95 percent to 105 percent of standard tonnage. The better outlook abroad brought foreign interests strongly into the market. In addition to the European interests, Japan was also a heavy buyer of copper. These events coupled with the demand for copper wire in the New England States, due in part to the hurricane, encouraged the domestic outlook. Both producers and fabricators are getting better releases against old orders, and some in the industry believe shipments to consumers in October will reach a substantial new high for the year.

The prices of *zinc* remained firm at 4.95c E. St. Louis until the middle of the month when they advanced to 5.05c, at which they remain at the present writing. Sales were as follows: the week ending October 1st 5,184 tons; the week ending October 8th, 2,961 tons; the week ending October 15th, 9,514, and the week ending October 22nd, the demand for zinc was light involving under 2,000 tons. Producers, however, continue optimistic over the zinc situation, with higher prices abroad and good shipments to consumers here. Shipments of high grade zinc to the automobile industry were reported in higher volume. The galvanizers' rate remains about 65 percent of capacity. At the end of the month, prices continued firm for Prime Western with 5.05c for E. St. Louis.

Cadmium prices remained constant throughout the month being quoted at 65c per lb. for commercial sticks, wholesale quantities, F.O.B. New York. London prices were also firm throughout the month.

Tin remained quiet throughout the first three weeks of the month but during the last week, operators encouraged by the favorable reports on the trend of business in the United States, moved the prices higher.

There was a fair amount of buying for tin-plate mills On Tuesday, the New York market for Straits tin in sympathy with London touched 46.50c. but later eased off to 46.25c. Chinese tin 99% was quoted at a high for the month, on October 25th, at 44.850c.

Lead transactions during the second week of the month boomed to 17,300 tons, the largest volume sold during any seven day-period so far this year. Buying was well diversified and some lead consumers supplying the automobile industry, specified metal delivery sooner than anticipated. Prices remain firm being quoted at 5.10c. New York and 4.95c. E. St. Louis. The consumer demand for lead abroad has improved since the war scare ended.

Silver prices remained firm throughout the month at 42¾c. per ounce Troy.

Scrap Metals. The end of the war scare reduced the foreign buying of copper scrap to a very low value and export demand continued very poor throughout the month, the copper refiners continuing to make the market for scrap. The movement of *secondary aluminum* into consumption improved throughout the month as well as carload prices which increased from 14.75c. delivered for grade No. 1 to 15c. at the end of the month. *Battery plate* offerings remained moderate throughout the month with smelting charges holding at $15.00. *Brass ingot* prices advanced during the month to 11⅜c. but brass ingot bookings and deliveries slowed up towards the end of the month, much to sellers' surprise.

WATCH FOR THE COMING ISSUES OF METAL INDUSTRY!

The December issue of Metal Industry will feature a symposium on filtering and equipment for filtering of electroplating solutions. One of the articles will be:

Activated Carbon Treatment of Bright Nickel Solutions by W. A. Helbig, Assistant Engineer, Sales Division, Darco Corporation, New York. This article will contain a description of the use of activated carbon as a treatment for bright nickel plating solutions to remove organic matter and similar materials which influence the quality of the bright nickel deposits.

In addition, the issue will contain articles on spray booths, buffing compounds and basic metals for the plating and metal working industry. The Post Scripts section will be expanded to include six thumb-nail biographies of prominent workers in the metal industry field.

Plans are under way for an extensive January Annual Review Issue containing a review of 1938 and a preview of 1939. This issue will include summaries of the advances of the year in plating solutions, equipment and theory. Starting with the January 1939 issue, a series of educational articles on Principles of Electroplating by N. E. Promisel, Electrochemist of the International Silver Company, Meriden, Conn., will be published together with a similar series of articles on Principles of Metallurgy.

WATCH FOR THE COMING ISSUES OF METAL INDUSTRY!

Supply Prices, October 31, 1938

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER:	Cast	20⅞c. per lb.
	Electrolytic, full size, 15⅞c.; cut to size	15⅞c. per lb.
	Rolled oval, straight, 16⅜c.; curved	17⅜c. per lb.
BRASS:	Cast	19½c. per lb.
ZINC:	Cast	10¼c. per lb.
NICKEL:	90-92%, 16" and over	.45 per lb.
	95-97%, 16" " "	.46 per lb.
	99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48c.	
SILVER:	Rolled silver anodes .999 fine were quoted Oct. 31, from 46c. per Troy ounce upward, depending on quantity.	

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P. l.c.l., drums	lb.	.06¼
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.054-.059
Chromic, 99%, 100 lb. and 300 lb. drums	lb.	.16¾-.17¼
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027
Hydrochloric, C.P., 20°, carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36°, carboys	lb.	.06
Nitric, 42°, carboys	lb.	.075
Oleic (Red Oil), distilled, drums	lb.	.08⅜
Oxalic, bbls. l.c.l.	lb.	.12-.14
Stearic, double pressed, distilled, bags	lb.	.105-.115
single pressed, bags	lb.	.10-.11
triple pressed bags	lb.	.135-.145
Sulphuric, 66°, carboys	lb.	.025
Alcohol, Amyl, l.c.l., drums	lb.	.126
Butyl-normal, l.c.l., drums	lb.	.10
Denatured, S.D. No. 1, 190 pf., bbls., works	gal.	.35
Diacetone, pure, l.c.l.	lb.	.12
Methyl, (Methanol), 95%	gal.	.31
Propyl-Iso, 99%, l.c.l., drums	gal.	.41
Propyl-Normal, drums	gal.	.70
Alum, ammonia, granular, bbls., works	lb.	.032
Potash, granular, bbls., works	lb.	.034-.037
Ammonia, aqua, 26°, drums, carboys	lb.	.025-.05¼
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.05-.075
Sulphate, tech., bbls.	lb.	.035-.05
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	.55-.58
Sulphocyanide (thiocyanate), com'l, drums	lb.	.16
Antimony Chloride (butter of antimony), sol., carboys	lb.	.17
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.028
Benzene (Benzol), pure, drums	gal.	.41
Butyl Lactate, drums	lb.	.225
Cadmium Oxide, l.c.l., bbls	lb.	.95
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05¾-.075
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05¾-.06
Carbon Tetrachloride, l.c.l., drums	lb.	.055
Chrome, green, commercial, bbls.	lb.	.22
Chromic Sulphate, drums	lb.	.26¼
Cobalt Sulphate, drums	lb.	.59
*Copper, Acetate (verdigris), bbls.	lb.	.25
Carbonate, 53/55%, bbls.	lb.	.155
Cyanide, Tech., 100 lb. bbls.	lb.	.34
Sulphate, Tech., crystals, bbls.	lb.	.05
Cream of Tartar (potassium bitartrate), crystals, kegs	lb.	.20¼
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07
Dibutyl Phthalate, l.c.l., drums	lb.	.195
Diethylene Glycol, l.c.l., drums, works	lb.	.16
Dextrine, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Ethyl Acetate, 85%, l.c.l., drums	lb.	.07
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20
Flint, powdered	ton	30.00
Fluorspar No. 1 ground, 95-98%, mines	ton	31.50
Fusel Oil, refined, drums	lb.	.125-.14
*Gold, Chloride	oz.	$18¼-23
Cyanide, potassium 41%	oz.	$15.45
Cyanide, sodium 46%	oz.	$17.10
Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Sandarac, prime, bags	lb.	.50
Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead, Acetate (Sugar of Lead), bbls.	lb.	.10-.12¾
Oxide (Litharge), bbls.	lb.	.125
Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Mercuric Oxide, red, powder, drums	lb.	$1.51
Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin	lb.	.05-.06
Phosphorus, red	lb.	.40-.44
yellow	lb.	.24-.30
Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Potassium, Bichromate, crystals, casks	lb.	.09¼
Carbonate (potash) 98-100%, drums	lb.	.06¾
Cyanide, 94-96%, cases	lb.	.525
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Quicksilver (Mercury) 76 lb. flasks	flask	$74.-$76.50
Rochelle Salts, crystals, bbls.	lb.	.18¼
Rosin, gum, bbls.	lb.	5.25-7.75
*Silver, Chloride, dry, 100 oz. lots	oz.	.40¼
Cyanide, 100 oz. lots	oz.	.43
Nitrate, 100 oz. lots	oz.	.35
Sodium, Carbonate (soda ash), 58%, bbls.	lb.	.0235
Cyanide 96%, 100 lb. drums	lb.	.15
Hydroxide (caustic soda) 76%, flake	lb.	.035-.057
Hyposulphite, crystals, bbls.	lb.	.035-.065
Metasilicate, granular, bbls.	lb.	.0315
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Pyrophosphate, anhydrous, bbls.	lb.	.071
Silicate, Meta, crystals, carload lots	lb.	.029
*Stannate, drums	lb.	.31-.34
Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Sulphocyanide, drums	lb.	.30-.35
Sulphur, Flowers, bbls., works	lb.	.037-.0410
*Tin Chloride, 100 lb. kegs	lb.	.355
Toluene (Toluol), pure, drums, works	gal.	.27
Tripoli, powdered	lb.	.03
Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.37-.39
Bees, yellow, crude	lb.	.21-.215
Carnauba, refined, bags	lb.	.37
Montan, bags	lb.	.115-.118
Spermaceti, blocks	lb.	.23-.24
Whiting, Bolted	lb.	.025-.06
Xylene (Xylol), drums, works	gal.	.31
Zinc, carbonate, bbls.	lb.	.13
Cyanide, 100 lb. kegs	lb.	.33
Chloride, granular, drums	lb.	.065
Sulphate, crystals, bbls.	lb.	.04

*Subject to fluctuations in metal prices.

Metal Prices on page 550.

Metal Prices, October 31, 1938

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

New Metals

COPPER: Lake, 11.375, Electrolytic, 11.25, Casting, 10.775.
ZINC: Prime Western, 5.05. Brass Special, 5.15.
TIN: Straits, 46.05. Lead: 4.95.
ALUMINUM: 20. ANTIMONY, Ch. 14.00.
NICKEL: Shot, 36. Elec., 35.
QUICKSILVER: Flasks, 75 lbs., $75-78. BISMUTH, $1.05.
CADMIUM, .65-.95. SILVER, Troy oz., official pr. N. Y., Oct. 31, 42¾c.
GOLD: Oz. Troy, Official U. S. Treasury price $35.00.
SCRAP GOLD, 6¾c. per pennyweight per karat, dealers' quotation.
PLATINUM, oz. Troy $35-37.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2⅛c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth. 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Ingot Metals and Alloys

	Cents lb.	Duty	U. S. Import Tax*
No. 1 Yellow Brass	9.375	None	4c. lb.[1]
85-5-5-5	11.625	None	4c. lb.[1]
88-10-2	15.00	None	4c. lb.[1]
80-10-10	13.375	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	11.375	None	4c. lb.[1]
Aluminum Bronze	15.625	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	13.375	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	15.625	20% a. v.	4c. lb.[1]
No. 12 Aluminum	13.50-15.25	4c. lb.	None
Manganese Copper, Grade A (30%)	22-27	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	15.00	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	15.50	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	21.50	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	50-60	None	None
Iridium Platinum, 5% (Nominal)	$38.50	None	None
Iridium Platinum, 10% (Nominal)	$40.00	None	None

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

Old Metals

Dealers' buying prices, wholesale quantities:

	Cents. lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	7⅝ to 7⅞	Free	4c. per pound on copper content
Light copper	7¼ to 7⅜	Free	
Heavy yellow brass	4⅝ to 4⅞	Free	
Light brass	4⅛ to 4¼	Free	
No. 1 composition	7⅛ to 7¼	Free	
Composition turnings	7 to 7⅛	Free	
Heavy soft lead	4¼ to 4⅜	2⅛c. lb.	None
Old zinc	2¾ to 3	1½c. lb.	
New zinc clips	3⅜ to 3½	1½c. lb.	
Aluminum clips (new, soft)	13 to 13¼	4c. lb.	
Scrap aluminum, cast	7¾ to 8	4c. lb.	
Aluminum borings—turnings	4 to 4¼	4c. lb.	
No. 1 pewter	27 to 28	Free	
Electrotype	4⅜ to 4⅝	2⅛c. lb.*	
Nickel anodes	27 to 28	10%	
Nickel clips, new	28 to 29	10%	
Monel scrap	8 to 15	10% av.	

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' lists, effective since Oct. 14, 1938. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

Copper Material

	Net base per lb.	Duty*
Sheet, hot rolled	19⅜c.	2½c. lb.
Bare wire, soft, less than carloads	15⅜c.	25% a. v.
Seamless tubing	19⅞c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty under Revenue Act of 1932.

Nickel Silver

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	26⅛c.	10% Quality	28¾c.
15% Quality	27½c.	15% Quality	32 c.
18% Quality	28½c.	18% Quality	34⅞c.

Brass and Bronze Material

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	
Sheet	17½c.	18⅜c.	19½	4c. lb.	U. S. Import Tax 4c. lb. on copper content.
Wire	17¾c.	18⅝c.	19⅝	20%	
Rod	13⅜c.	18⅝c.	19⅝	4c. lb.	
Angles, channels	26c.	26⅞c.	28	12c. lb.	
Seamless tubing	20¼c.	20⅞c.	21⅞	8c. lb.	
Open seam tubing	26c.	26⅞c.	28	20% a. v.	

Tobin Bronze and Muntz Metal

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.

Tobin Bronze Rod	19⅜c.
Muntz or Yellow Rectangular and other sheathing	20¾c.
Muntz or Yellow Metal Rod	16⅞c.

Aluminum Sheet and Coil

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, carload lots, per lb.	33.00c.
Aluminum coils, 24 ga., base price, carload lots, per lb.	28.50c

Rolled Nickel Sheet and Rod

Net Base Prices

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Hot Rolled Rods (base)	35c.	No. 35 Sheets (base)	37c.
Cold Drawn Rods (base)	40c.	Std. Cold Rolled Sheets (base)	39c.

Silver Sheet

Rolled sterling silver (Sept. 29) 45c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

Zinc and Lead Sheet

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots standard sizes and gauges, at mill, less 7 per cent discount	9.75	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	10.75	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	14.75	2c. lb.
Full Lead Sheet (base price)	8.00	2⅜c. lb.
Cut Lead Sheet (base price)	8.25	2⅜c. lb.

Block Tin, Pewter and Britannia Sheet

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 548.

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